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Journal of the Royal Army Medical Corps.

Original Communications.

HAVE TRYPANOSOMES AN ULTRA-MICROSCOPICAL STAGE IN THEIR LIFE-HISTORY?[1]

BY COLONEL SIR DAVID BRUCE, C.B., F.R.S., AND CAPTAIN H. R. BATEMAN.
Royal Army Medical Corps.

(Received June 6,—Read June 25, 1908.)

BY an ultra-microscopical stage in the development of a micro-organism is meant a stage in which the parasites are so small as to be invisible to the highest powers of the microscope, and to be capable of passing through the pores of a porcelain filter. For example, a drop of South African horse-sickness blood will give rise to the disease if injected under the skin of a healthy horse. If a similar drop is examined under the highest available powers of the microscope, nothing in the shape of a micro-organism can be seen. If this blood is filtered through a porcelain filter, the virus passes through, and the filtrate is found to be as infective as the original blood. Horse-sickness is therefore looked upon as a disease caused by an ultra-microscopical micro-organism.

For some time it has been reported by various workers that an ultra-microscopical stage exists among the trypanosomes. For example, Plimmer informs us that he found the filtered blood of nagana animals to be infective. Salvin Moore and Breinl write that the blood of animals suffering from *Trypanosoma gambiense* infection, although apparently containing no trypanosomes at all, and even if properly filtered, is still capable of infecting other animals

[1] Reprinted from the *Proceedings of the Royal Society*, B. vol. 80.

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into which it may be introduced. MacNeal also makes a similar statement in regard to *T. lewisi*. He states that "in culture, on blood-agar, *T. lewisi* may give rise to much smaller forms, and that such cultures, after passage through a Berkefeld filter, still infect rats." Finally, it may be noted that the late Dr. Fritz Schaudinn, whose too early death we all lament, expressed the belief that trypanosomes may multiply by longitudinal division so rapidly as to become small enough to pass readily through a Chamberlain filter.

This subject is an important one, as the discovery of an ultra-microscopical stage in these trypanosomes might throw light on the causation of some diseases in which no parasite can be found. In kala-azar, for example, the intra-corporeal form is small, and the extra-corporeal a fairly large flagellated organism. Let us imagine that the Leishman body lying inside the splenic cells had still further subdivided and become ultra-microscopical, then we would have an invisible parasite causing a serious disease in man and developing outside the body into a clearly visible flagellate. It is evidently important, then, in studying such diseases as South African horse-sickness, to try the effect of planting out the blood on various media, and looking for a visible stage of development in different insect hosts.

The following experiments were made to test the truth of the statement that trypanosomes have this invisible stage. The filters used were Berkefeld's ordinary filters for laboratory use. They were tested before use and found to readily keep back *Micrococcus melitensis* from the filtrate. The apparatus was attached to a Sprengel's pump :—

To ascertain if the Filtered Blood of Rabbits suffering from Nagana is infective.

Experiment 23.

March 20th, 1908.—A rabbit which was inoculated on February 7th, 1908, with *T. brucei*, was killed to-day in an advanced stage of nagana. On microscopical examination of the peripheral blood and blood from the heart, no trypanosomes were seen. Portions of the heart, lungs, liver, spleen, kidneys, and bone-marrow were pounded up in a mortar with 1 per cent. sodium citrate in normal saline. The resulting emulsion was then filtered through a Berkefeld filter, and 1 cc. of the filtrate injected subcutaneously into each of two white rats.

April 30th, 1908.—Both rats healthy. No trypanosomes have appeared in their blood.

Experiment 26.

April 24th, 1908.—Rabbit inoculated with *T. brucei* on March 26th, 1908. Same procedure as in Experiment 23.

May 21st, 1908.—Both rats healthy.

Experiment 35.

March 31st, 1908.—Rabbit inoculated February 7th, 1908. Same procedure as in Experiment 23.

May 4th, 1908.—Both rats healthy.

Experiment 51.

January 31st, 1908.—Rabbit inoculated January 10th, 1908. Same procedure as in Experiment 23.

March 25th, 1908.—Neither rat showed trypanosomes at any time in its blood.

Experiment 53.

February 3rd, 1908.—Rabbit inoculated January 10th, 1908.

March 30th, 1908.—Result negative. Both rats healthy.

Conclusion.

From these five experiments it would appear that the blood or organs of rabbits suffering from nagana does not contain ultra-microscopical forms of *T. brucei*.

To ascertain if the Filtered Blood of White Rats Suffering from Nagana is Infective.

Experiment 40.

December 17th, 1907.—A white rat, suffering from nagana, and whose blood was swarming with *T. brucei*, was killed to-day. The organs and bone-marrow were made into an emulsion with 1 per cent. sodium citrate in salt solution and filtered in the usual way. Half a cubic centimetre of the filtrate was then injected into the peritoneal cavity of a white rat.

March 16th, 1908.—This rat has never shown trypanosomes in its blood.

Experiment 41.

December 17th, 1907.—This rat was also injected with the same quantity of filtrate as in Experiment 40.

April 1st, 1908.—Trypanosomes have never appeared in the blood.

Experiments 42 *and* 43.

December 24th, 1907.—A nagana rat, whose blood was swarming with trypanosomes, was killed, and the organs, &c., emulsified

and filtered. One cubic centimetre of the filtrate was injected intra-peritoneally into two white rats.

March 30th, 1908.—Both rats healthy.

Experiments 44, 45, 46, 47, 48, 49, *and* 50.

This procedure was repeated seven times in exactly the same way and always with a negative result.

Conclusion.

From these eleven experiments it would appear that the blood of nagana rats filtered through a Berkefeld filter is not infective.

To ascertain if the Filtered Blood of White Rats Suffering from Nagana or Surra, and treated for various Periods with Antimony, is infective.

It was thought that the effect of treatment on animals suffering from nagana might lead to the development of small resting forms of the *T. brucei* which might be capable of passing through a Berkefeld filter. The effect of certain drugs on animals suffering from nagana is marvellous. The blood may be swarming with trypanosomes, yet within an hour of the injection not a single one can be seen. They may remain out of the blood for weeks or months in some out-of-the-way place, and, perhaps in some resistant form.

Experiment 28.

March 26th, 1908.—A white rat, whose blood was swarming with *T. brucei*, was treated with $\frac{1}{2}$ cc. of a $\frac{1}{4}$ per cent. solution of sodium antimonyl tartrate. The rat died half an hour after receiving this dose. The organs and bone-marrow were emulsified and filtered in the usual way, and 1 cc. of the filtrate injected subcutaneously into a white rat.

May 7th, 1908.—Trypanosomes have not appeared in the blood.

Experiment 29.

March 27th, 1908.—A white rat, whose blood was swarming with *T. evansi*, was injected with $\frac{1}{2}$ cc. of a $\frac{1}{4}$ per cent. solution of sodium antimonyl tartrate. This rat died half an hour after receiving the dose. Emulsion of the organs and bone-marrow made and filtered in the usual way, and 1 cc. of the filtrate injected into two white rats.

April 29th, 1908.—Both rats remain well.

Experiment 33.

March 30th, 1908.—A white rat, whose blood was swarming with *T. evansi,* was injected subcutaneously with $\frac{1}{2}$ cc. of a $\frac{1}{4}$ per cent. solution of sodium antimonyl tartrate. This treatment was continued for a month, the animal receiving in all eleven doses.

May 4th, 1908.—Rat killed and its organs and blood emulsified and filtered. Half a cubic centimetre of the filtrate was injected intra-peritoneally into two rats.

June 4th, 1908.—Both rats healthy.

Experiment 66.

March 8th, 1908.—A white rat, whose blood was swarming with *T. brucei,* was injected with 2 drops of a 1 per cent. solution of sodium antimonyl tartrate. This treatment was continued for a month, the animal receiving in all eight doses.

April 10th, 1908.—Rat killed and its organs emulsified and filtered in the usual way. One cubic centimetre of the filtrate injected into two rats.

May 11th, 1908.—Both rats healthy.

Experiment 19.

March 8th, 1908.—A nagana rat, whose blood was swarming with *T. brucei,* was injected on the third day of disease with 2 minims of a 1 per cent. solution of sodium antimonyl tartrate.

March 9th, 1908.—Repeated injection. A few trypanosomes in blood.

March 11th, 1908.—Repeated injection. A few trypanosomes in blood.

March 13th, 1908.—No trypanosomes in blood.

March 18th, 1908.—Blood swarming with trypanosomes. Injected $\frac{1}{2}$ cc. of a $\frac{1}{4}$ per cent. solution of sodium antimonyl tartrate. Rat died five minutes later. Organs emulsified and filtered and $\frac{1}{2}$ cc. of the filtrate injected into a white rat.

March 26th, 1908.—This rat's blood is found to be swarming with trypanosomes. It is evident that something has passed through the filter capable of infecting a rat with nagana; but it is possible that the filter has become defective on account of wear. It was tried again with a cultivation of *Micrococcus melitensis* in broth and failed to keep back the micrococci from the filtrate. It was therefore concluded that the filter was defective, and this experiment null and void.

Conclusion.

From these experiments it may be concluded that the blood of white rats suffering from nagana and treated for varying times with antimony salts does not contain ultra-microscopical forms of *T. brucei.*

To ascertain if the Cultivation of Trypanosomes on Blood-agar will give rise to Ultra-microscopical Forms which are capable of passing through a Berkefeld Filter.

Experiment 24.—*White Rats.*

March 20th, 1908.—The water of condensation from six flasks of blood-agar, upon which *T. lewisi* had been planted out for eighteen days, was to-day filtered through a Berkefeld filter, and $\frac{1}{2}$ cc. of the filtrate injected into two white rats.

April 28th, 1908.—These rats have remained in good health and no trypanosomes have appeared in their blood.

Experiment 37.—*White Rats.*

April 1st, 1908.—A test-tube of blood-agar (2—1), which contained a luxuriant growth of *T. lewisi,* was shaken up with 25 cc. of normal salt solution, and the resulting emulsion filtered through a Berkefeld filter. The filtrate was then injected into the peritoneal cavity of three white rats.

April 30th, 1908.—All three rats remained well, and trypanosomes never appeared at any time in their blood.

Experiment 36.—*White Rat (Control).*

March 31st, 1908.—To ascertain if the culture used in Experiment 37 was virulent, three drops of the condensation fluid were injected into a small white rat.

April 6th, 1908.—*T. lewisi* appeared in the blood of this rat.

Experiment 64.—*White Rats.*

April 9th, 1908.—A blood-agar tube containing a growth of *T. lewisi,* first generation, forty-sixth day of growth, was shaken up with normal saline and filtered in the usual way. The filtrate was injected intra-peritoneally into two rats.

May 11th, 1908.—Both rats well. Trypanosomes have never appeared in their blood.

Experiment 98.—*White Rats.*

May 7th, 1908.—Two blood-agar tubes, twenty-seventh day of growth. Same procedure as in Experiment 64.

June 2nd, 1908.—Both rats healthy.

Experiment 97.—*White Rat* (*Control*).

May 7th, 1908.—To ascertain if the culture used in Experiment 98 was infective, ½ cc. of the condensation fluid was injected intraperitoneally.

May 18th, 1908.—*T. lewisi* in the blood.

Conclusion.

From these experiments it may be concluded that cultures of *T. lewisi* on blood-agar do not give rise to ultra-microscopical forms which are capable of passing through a Berkefeld filter.

The final conclusion arrived at is that neither *T. brucei* nor *evansi* develops in the body of an animal forms so small as to be capable of passing through the pores of a Berkefeld filter, and that in cultures of *T. lewisi* on blood-agar such small forms are also absent.

TACTICS AND THE HEALTH OF THE ARMY, 1848—1908.[1]

By Field-Marshal Sir EVELYN WOOD, V.C.

I.

Very few Britons, except those in the Medical profession, read papers concerning, or even give a thought to, the health of the defenders of the Empire.

The steady progress during the last decade in equipping the British soldier mentally, physically, and mechanically for war is noted with satisfaction by the Press, and credit is sometimes given to Field-Marshal Viscount Wolseley and to certain of his subordinates in that, after many years of struggle, they overcame the prejudice against reforms which for so long delayed the battle-training of our troops.

This prejudice induced blind adherence to obsolete exercises and formations hallowed by glorious victories gained by our indomitable soldiers under Marlborough and Wellington, formations which became incompatible with success under the fire of accurate long-range cannon and rifles. There are probably few persons who realise that the British infantry sailed for the East in 1854 carrying the musket used at Waterloo in 1815, and that at the Alma the 4th Division was still without a rifled weapon. The progress in battle-training was so deliberate that in 1888, when I assumed the command at Aldershot, the favourite Artillery battery exercise was "changing front to the Right and Left on the centre subdivision," which is of as much direct use for battle-training as dancing a cachucha would be to a prize-fighter when emerging from his corner.

The South African War justified the consistent efforts of Viscount Wolseley, and that its lessons have been assimilated is evident both from what was seen in September on Salisbury Plain and later in Hampshire.

On the Plain there were troops of all arms, including the largest body of British cavalry, some 5,000 horsemen, ever brought together. Officers of experience said the satisfactory progress was undoubted. It was, moreover, noticed that in Hampshire a large body of troops of all arms was so well handled as to be scarcely seen by day ere it got into touch with its foes; and also that its

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[1] Reprinted by permission of the Editor of *The Saturday Review*.

night march, to gain a position whence it might assault at daylight, was remarkably well executed.

The interest taken in the Salisbury Plain manœuvres, not only by the leisured classes but also by the general public, is shown by the space given in the daily press to picturesque narratives of mimic battles.

While it is true that manœuvres are usually held when Politics and, to some extent, Commerce and other engrossing subjects are in a state of suspended animation, yet on the other hand there remains ample evidence of a considerable amount of interest in the war-training of the men who in the United Kingdom enable the great majority of Britons to evade the law of self-preservation, a National duty which falls on every adult on the Continent.

Important as is the higher training in tactics, or the art of killing with the minimum of personal risk, yet all improvements therein have been surpassed by the life-saving labours of the Army Medical Department. It is probable that future generations will acclaim surgeons as the most notable benefactors of the human race during the Victorian epoch, but their art in the Army comes into use only after battles, and for every ten men saved by the skill of surgeons preventive medicine saves its tens of thousands. It was not studied in 1848. Soldiers were generally recruited from the classes of farm labourers and journeymen. Each man was carefully inspected, one-third of those offering themselves only being accepted by the doctors as fit for service. Those who got seriously ill were invalided, and thus passed back to the civil population; yet that population had somewhat less than half the mortality of the picked men who remained in the Army. At that time in civil life clerks in offices furnished the greatest proportion of 140,000 men, in a population of 28,000,000 in England, who died every year before their natural time, in addition to those who became chronic invalids. The clerks, like the soldiers, died "from want of fresh air." Sixty years ago not only were the barrack-rooms destitute of every convenience found in an ordinary house, but were without any arrangements for common decency.

The British soldier owes much to the unwearied efforts of Mr. Sidney Herbert, Secretary of State for War, who, helped by the excitement caused by the story told by Dr. W. Howard Russell in the *Times* of the incredible sufferings of our troops in the Crimea, focussed for some time the attention of Parliament in one Session, and thus did much to mitigate our stupid extravagance in the unnecessary expenditure of human life. As a witness before Mr.

Herbert's Committee stated, "A soldier never knows a healthy home until he commits a crime which places him in a thoroughly well-ventilated cell of a military prison."

Soldiers in barrack-rooms were supposed to have 400 cubic feet of space, but in many cases they had not more than 200, the beds just touching instead of being 3 feet apart. This would in itself account for much of the sickness. In France about the same time (1847) there was a striking object lesson of the evil effects of overcrowding. The garrison of St. Cloud, from 400 to 500 men, was always very healthy until the Court moved there in October, when 800 additional men were placed in the barracks, and every year within a short time after the augmentation typhoid fever broke out, many cases ending fatally.

It is a remarkable fact that while the British Government allowed our soldiers to be poisoned by foul air, the ventilation of Government stables received great attention. There were other contributory causes to the soldier's ill-health, some within his own control, but his monotonous dinner of boiled beef daily for twenty-one years must have prejudiced his vigour; his insanitary surroundings were the greatest detriment to his health in peace service. The Medical officers, when they did try to remedy evils, were generally discouraged and told to "mind their own business," for it was not then recognised that prevention of disease is even more important than its cure.

The Medical officers of the Guards urged for years that the foul stagnant water should be drained off the Tower ditch, to the evil odours of which many fatal cases of typhus were attributed; but nothing was done to abate the nuisance until the civil population having votes for the election of a member of Parliament complained of the danger.

In the late 'forties a new barrack in the Tower was temporarily used as a blanket store. During an outbreak of fever the doctors proposed to move the Guards detachment into the new buildings and the blankets into the old quarters. The application was refused on the remarkable ground that the dampness of the old rooms would injure the blankets. Fortunately the story came to the ears of the Duke of Wellington, who upset the decision.

Prior to the Crimean War the troops in Knightsbridge Barracks were supplied with water from the Serpentine, but this abuse was eventually rectified in the interest of the troop horses. In the summer, when the number of bathers using soap increased, the horses, drinking less, daily lost condition, and finally refused to

look at the water. This compelled a change in the source of supply.

Bad as were our sanitary arrangements for the soldiers in peace, their inadequacy was not so perceptible as was the lamentable absence of all provision for keeping the men in health in war-time or for caring for them when sick. In the Crimea the loss by shot, shell, and bullets was but a small fraction of that due to preventable causes. From October, 1854, to March, 1855, the percentage of sick varied from 24 to 51, the average being 39; in other words, only 61 out of every 100 were at duty. Sixty out of every 100 men in the Crimea between October, 1854, and May, 1855, died, and in eight of the most hardly worked battalions the percentage of fatalities amounted to 73 men. During seven months, on an average strength of 28,000 men before Sevastopol, 10,000 died from disease, which exceeds the mortality of the Great Plague of 1665. These statistics indicate the vast importance of the Medical officer's primary duties.

One of the saddest records is that given by the officer commanding the 21st Fusiliers (Royal Scots Fusiliers). The battalion suffered heavily, but "forty-seven were unaccounted for, being either those who fell out in the march (from the Alma) and could not be brought along, or those who died on passage to Scutari, having never been heard of since." There was no transport for sick or wounded in 1854!

When the Army was ordered to the East in 1854, the Director-General of the Army Medical Department obtained permission to despatch three officers by various routes to Constantinople as collectors of Sanitary statistics. The information was duly received, but nothing came of it, the Commander-in-Chief declining to approve the abolition of the tight-fitting leather stock or the provision of flannel shirts, drawers, socks, &c., recommendations which had been endorsed by the Director-General; and as he did not support the other valuable Sanitary suggestions made by one of his experts, nothing was done in the matter, and the officers might as well have remained at home.

Each battalion, on going out to the East, had Medical officers attached to it and a Regimental hospital, but in its equipment only one blanket was allowed for each patient, and there was a deficiency of medicine from the first landing in the Dardanelles in April, 1854. This complaint was reiterated for months, the surgeon of the 55th Regiment (2nd Battalion the Border Regiment) writing on November 26th, 1854, "with many cases of dysentery and diarrhœa I can obtain no castor oil, no preparation of opium."

The Regimental medical officers, although they were eventually driven by compassion for their men's sufferings to speak out, yet were at first afraid of incurring censure from their Departmental superiors if they complained. This is not surprising, as a senior Medical officer in a camp near Varna, where cholera killed many in the summer of 1854, was told "his recommendations would be asked for if they were required." This suppression not merely of all zeal but of proper sense of duty possibly accounts for the Medical officers of the Light Cavalry Brigade begging Lord Cardigan not to mention their names in reporting they had no medicines for the sick, and may also account for the fact that when the Principal Medical officer in the Crimea protested on January 24th, 1855, against the issue to the troops of unground coffee he was unaware that they had only received unground green coffee ever since the previous November. The junior officers in the Royal Army Medical Corps have long since ceased to feel such nervous apprehension of their superiors.

The Military chiefs' ostentatious disregard of the timidly expressed recommendations of the doctors was a repetition of what had occurred sixty years earlier, for Dr. Jackson, writing in 1799, notes "the unwillingness of commanders to accept advice on subjects which they could not themselves be supposed to know."

There is no record to show whether the Medical officer of a hospital adjacent to Balaklava, or the Principal Medical officer who lived at Lord Raglan's headquarters about three miles distant, or a Staff officer, or some private individual first drew attention to the most insanitary spot within the British lines in the Crimea. The little inlet from the Black Sea, some 800 by 300 yards, overshadowed by lofty cliffs, called Balaklava Harbour, was in 1854-55 a painful object-lesson, indicating our want of Sanitary knowledge. The General-in-Chief deliberately accepted serious tactical disadvantages to please the Admiral-in-Chief, who earnestly urged that the British and not the French should hold Balaklava. Our Allies acquiescing, we took charge of the place, but for months let it remain unscavenged, making but few latrines and no slaughter-houses. The Turkish troops quartered in the Tartar village of 500 inhabitants were nearly starved and insufficiently clad. Their numerous dead were buried in shallow graves near the head of the harbour, and the level of the water rising with the wind blowing in from the sea uncovered the corpses. Dead horses were buried close to where the sick soldiers were embarked; the water and shore on one side of the harbour were covered by a mass of putrid

animal and vegetable refuse. When after many months steps were taken to remedy the evils which should never have been allowed to arise, the Herculean cleanser of our filthy Base, Admiral Boxer, and many others died of cholera induced by British mismanagement.

II.

Twenty years after the war in the Crimea the Sanitary and Medical arrangements for the Ashanti expedition, 1873-74, left nothing to be desired, but the circumstances were exceptional. The two European battalions were only on shore for seven weeks and in the best season; the General in command was a military genius; his first and very capable medical officer was a former brother-officer in the 90th Light Infantry (2nd Scottish Rifles), and enjoyed the General's confidence. Dr. Anthony Home, V.C., C.B., preceded the expedition by four months. He studied closely the pestilential climate of the Gold Coast, and had matured his plans for the prevention of sickness when Sir Garnet Wolseley arrived and approved them. Later, when Dr. Home, struck down by fever, was invalided, he was replaced by another selected and capable officer, Surgeon W. Mackinnon, C.B., who afterwards became Director-General of his Department. The detailed plans for transporting sick and wounded 150 miles from Coomassie to the coast on a narrow path through dense forests show plainly the advance in war-service efficiency between 1854 and 1874.

It would not be reasonable to remark on the want of medical organisation in the first stage of the Zulu War, since it was undertaken by the High Commissioner before adequate preparations were made; but it brought to light some curious repetitions of Crimea experience, when drugs were more valued than soldiers. A column of 2,500 troops, under the command of the writer of this paper, although in daily communication with the base, was left without castor oil and necessary drugs for a fortnight, in spite of constant and urgent requisitions, and although the articles were procurable in chemists' stores in Durban and Maritzburg.

Between September, 1881, and February, 1882, an epidemic of enteric fever in Natal brought to light the unsatisfactory conduct of some of the Army Hospital Corps employed as nurses, and the wife of a senior Staff Officer, a charitable lady who was much interested in the nursing of soldiers, alleged that "the heavy loss which ensued was caused by the cruel neglect of the Hospital orderlies." In June, 1882, a Court of Inquiry, the writer himself

being President, was assembled, and after considering the evidence of several soldiers who complained of ill-treatment, in some cases "of a cruel nature," recorded an opinion that the more serious allegations against the Army Hospital Corps had not been substantiated. The evidence showed plainly that the philanthropic lady was mistaken in her estimate of the loss, which indicated a lower percentage than that of enteric cases in the United Kingdom and only one-third of that in India. It illustrated clearly, however, that the Regulations were inelastic and faulty, and convinced the Adjutant-General and his successors in that office, Sir Redvers Buller and Sir Evelyn Wood, that the employment of female nurses, wherever they could be accommodated, should be at once approved.

Lord Morley's Committee, appointed in October, 1882, to enquire into the organisation of the Army Hospital Corps and nursing, was directed later to extend its enquiries into the organisation of the Medical Department, with special reference to the expedition to Egypt. The report was most valuable, in spite of the fact that of the eight members three wrote dissentient minutes, and that the evidence of the Chief of the Staff conflicted with that of the General-in-Chief. The Committee considered, and concurred generally, however, as regarded the nursing arrangements, in the conclusions submitted by Sir Evelyn Wood's Committee six months earlier. They commended the "skill and care of the medical officers," but reported that "the nursing, feeding, and Hospital administration left much to be desired."

The Medical and Sanitary arrangements for the Sudan expedition of 1884-85 reflect credit on all concerned; and in the final despatch of the General in command it is recorded "the sick and wounded have never been better cared for." The great length of the line of communication, 1,500 miles from Alexandria to Gubat, necessitated the provision of many doctors and all forms of "Sick Transport"; camels on the desert, whaleboats, native craft, and steamers on the reaches of the Nile between cataracts, hand-stretchers and donkeys over the portages, and ambulance carriages on the railways.

Careful notifications of all sick treated were sent out from all hospitals to regiments in the front, along the line of communications, and also to the Statistical Office at Cairo; thus every soldier admitted to hospital was traced. Nursing sisters were employed in the large hospitals at Assuan and Halfa, to the benefit of patients, but only after much opposition of the doctors to the system. The

satisfactory transport of the wounded across the Bayuda Desert from Gubat to Korti on the Nile, about 180 miles, showed how marked was the advance of the Medical officers in service efficiency. Many wounded had undergone capital operations, yet none appeared to the writer of this paper at Gakdul, midway on the desert in the great bend of the Nile, to suffer in the camel cacolets, although the movements of camels are generally trying to a sick man. This is a striking contrast to our experience in the overcrowded and polluted hospitals at Scutari in 1854-55, when thirty-nine out of forty patients succumbed under secondary operations after a short sea voyage.

During the Boer War there was much controversial newspaper correspondence regarding the administration of British hospitals, and various complaints were made, often of a sweeping character, against the Royal Army Medical Corps. There had been many committees of investigation after previous wars, but Governments are now more democratic, and as they reap the advantage of the support of the electorate, so are proportionately sensitive to criticism, even if misplaced; and in 1900 the Cabinet appointed a Royal Commission, consisting of a Lord Justice of Appeal, two doctors, and two eminent civilians, to enquire in London and throughout the Seat of War concerning the treatment of the sick and wounded. The Commissioners came to the conclusion that the main cause of complaint was the insufficiency of the Royal Army Medical Corps, the constant requests of its chiefs for larger establishments having been consistently refused. Up to September, 1899, there were 20,000 soldiers in South Africa, then 30,000 were added monthly until July, 1900, after which 11,000 more landed every month.

In September, 1899, there were in South Africa thirty military doctors and 270 subordinates. During the war the number employed amounted to 900 doctors, 400 nurses, and 6,400 subordinates; but they had to deal with the non-effectives of 230,000 soldiers not only stationed, but also when moving all over a roadless continent, the military operations on which extended 1,100 miles from north to south and 600 miles from east to west.

The Commissioners, after stating that a very small proportion of the doctors were unfit, reported that "the Medical officers never spared themselves, showed great devotion to duty, both at the Front and in the fixed hospitals . . . . the unselfish way in which they attended to the sick and wounded, often at the risk of life, has been recognised by all impartial witnesses"; and then went on to record that the Home and Cape Town Base authorities

met promptly all the requisitions on them, and that all witnesses of experience in other wars were practically unanimous that, "taking it all in all, in no campaign have the sick and wounded been so well looked after."

The Annual Medical reports and the journal mentioned below indicate clearly how the Army Medical Department has advanced in scientific knowledge. At Poona, in the Bombay Presidency, the ratios per 1,000, of admissions for venereal diseases have fallen gradually from 416 in 1903 to 70 in 1906. The Annual Report for 1907 shows an all-round improvement. Malta fever has been practically stamped out since the doctors discovered its originating causes, and with the compulsory cessation of the use of goats' milk, which contained the fever germs, the number of admissions to hospital has dropped successively for three years from 643 to 161, and 11 cases.

The troops in India have benefited greatly from the improvement in medical science and from the increased knowledge of the doctors as regards sanitation. In the forty years between Waterloo and the Crimean campaign, according to Colonel Tulloch, nearly 100,000 Europeans perished in India from preventable causes. For the first half of this period the Army numbered 25,000 men, and later was raised to 40,000. This terrible mortality, mainly in Bengal, was the result of a want of sanitary knowledge in the selection of cantonments. Apart from humane considerations, the monetary loss alone, irrespective of that of invalided soldiers, amounted to £10,000,000.

Formerly the most dreaded station was Mian Mir, the Lahore cantonment. There in 1879 the admissions per 1,000 men from fever alone were 3,427, and from all causes, 4,102. Ten years ago the average of admissions was 2,287 per 1,000, but it has dropped gradually one or two hundred annually until last year, when it was 579 per 1,000. It is natural that the number of constantly sick in India should be higher than it is in the United Kingdom, and it is still double; but those now in high commands appreciate the financial as well as the humanitarian importance of the question.

No one has attributed to the present Commander-in-Chief in India an excess of sentiment, but his reported determination of naming first for employment on service the healthiest corps, irrespective of their peace station, is likely to make all ambitious regimental officers strong supporters of the doctors, so further improvement may be expected.

The change in the Medical Department within the writer's Staff

service, which began over fifty years ago, is indeed remarkable. All officers who can recall the events of the late 'sixties must remember the strenuous opposition to the abolition of the Regimental Hospital system—opposition by the Regimental officers, and by the majority of the doctors. Old officers must realise now the great advantage of the change, but it is probable that few laymen appreciate the immensity of the advance. It may to some extent be appreciated by a perusal of the "Monthly Journal" of the Royal Army Medical Corps, published without State aid, and which even to a combatant officer without any medical knowledge shows how the standard of professional knowledge is rising. The association of doctors with the Gymnastic Staff will not only prevent injury being caused by zealous instruction without anatomical knowledge, but will tend to keep the true principle in view—that the object of all physical training is to increase the working capacity of the soldier.

The Army Council has recently decided that Sanitation shall in future form one of the subjects for examination for promotion for junior Regimental officers. The importance of this step may be judged by recalling that in the first Army Staff ride, carried out in 1897, there were no Medical officers employed. Now their attendance and instruction are generally assumed as being essential.

In the Scottish Command, by means of a "Station Sanitary Book," the officer in Command and the officer in Medical charge have been brought into close and effective relations.

All this is satisfactory, but more remains to be done. I am convinced, from my experience of thirty years as a General, that the Army doctors should be regarded not merely as healers of sick and wounded, but as trusted Staff officers to advise their chiefs how to guard the troops against the originating and spreading of disease, and thus maintain the number of Effectives in a campaign. This will result not only in the increasing of fire effect, but will raise immensely the fighting value of the troops, and will incidentally enable us to reduce the costly and cumbersome Hospital establishments and transport.

TUBERCULOSIS IN THE BRITISH ARMY, AND ITS PREVENTION.[1]

By Lieutenant-Colonel R. J. SIMPSON, C.M.G.
Royal Army Medical Corps.

In dealing with the question of the prevalence of tuberculosis in the British Army, especially in relation to its prevention, there are two stages into which the enquiry must be divided. The first relates to the present prevalence as compared with that in former years, the second to those alterations in conditions to which any changes in the prevalence may be attributed. Further, the Army is, after all, only a portion of the general population which has for a certain period been subjected to conditions which are not those which obtain among the general population. Hence no consideration of the prevalence in the Army can be complete without some reference to the prevalence in these islands generally.

I.

The Present Prevalence of Tuberculosis in the Army as Compared with that in Former Years.

There are several factors which make it extremely difficult to make a comparison between the present incidence and that of earlier periods with any high degree of accuracy. These may be grouped as follows:—

(*a*) *Changes in the Nomenclature of Disease.*—These changes are, of course, well known; they have followed and depended on the various hypotheses of the origin of certain pathological conditions, and it was not till the true specific nature of the various lesions was recognised that a rational nomenclature was adopted. Hence the boundaries of each class of disease were in the earlier years far less definite than they are now, and one has to rearrange the statistical records for this period to make them comparable with the current statistics, and here we have a possible source of error.

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[1] This article was written in response to a request from the Editorial Committee of *Le Caducée*, and has been published in the issue of that Journal dated October 17. The Editorial Committee has kindly given permission for the republication.

The information regarding the condition of barracks in former years has been chiefly derived from an article by Lieutenant-Colonel Melville, R.A.M.C., in the *British Journal of Tuberculosis* for January, 1908; he has also kindly supplied the figures from which the diagram has been constructed.

This error affects all the particulars, the morbidity, mortality and total loss by death and discharge from the Service.

(*b*) *Changes in the Conditions of Service, i.e., in the Period for which the Soldier Enlists.*—"As a general rule, until the year 1847, the term of service of men enlisted in time of peace was for life." In 1847, the Army Service Act (amended in 1849) limited first engagements to ten or twelve years in different branches of the Service, but allowed re-engagements to complete a period of twenty-one or twenty-four years service, and even longer under special authority. By the Army Enlistment Act, 1867, first engagements were to be for twelve years, with power to re-engage to complete twenty-one years' service, and even more under special authority. In all these cases the term of engagement was for actual "colour service," *i.e.*, continuous military employment.

In 1870 the system known as the short service system was introduced and has continued in force ever since. The essential distinction of this system is that under it a soldier passes part of the time for which he enlisted, twelve years, with the colours, and the remainder with the reserve, remaining still liable to be summoned for colour service in case of emergency till the expiration of the term for which he enlisted. A proportion are still permitted to pass the whole term of enlistment with the colours, and a smaller proportion to re-engage to complete twenty-one years, or in special cases even longer. But by far the greater proportion of the men pass into the Reserve after their normal term of colour service: that is, return to civilian life; and the numbers serving for long periods are in no way comparable with those under the older systems. The actual time during which the majority of the men are engaged in actual military employment, *i.e.*, with the colours, has varied from time to time for the whole Army, and more especially for certain sections of it, but the longest period of service with the colours has not been more than nine years under this system, and the more usual period not more than seven.

Although the short service system became legal in 1870, it was not at first fully adopted, and as there were a large number of men serving under the old conditions of enlistment, it was not until about 1880 that the influence of the new system in reducing the age of the Army was at all important. Unfortunately, records of the age distribution of the Army between 1877 and 1889 are not now available, but the following table shows the average age of the Army serving in the United Kingdom between 1860 and 1905, with the exceptions noted :—

Year	Mean age	Standard deviation
1860 ..	24·61 ..	5·90
1865 ..	26·40 ..	5.75
1870 ..	25·93 ..	6·50
1875 ..	27·07 ..	7·25
* *	* *	*
1890 ..	23·61 ..	5·95
1895 ..	23·78 ..	6·00
1900 ..	25·47 ..	7·50
1905 ..	24·04 ..	6·30

One sees from this table that, having regard to the standard deviation, the Army in the United Kingdom was of greatest average age in 1865, and that from 1870-75 the average age did not differ very materially from this. From 1890 the average age decreased, to rise again during the South African War, the influence of which had not disappeared in 1905.

If one examines the proportion at each age per 100 of strength at all ages, it is easy to see that the cause of the difference lies in the proportion of the whole who were under thirty years of age, as follows :—

1860	Of every 1,000 men	831	were under 30	years of age	
1865	,, ,,	765	,,	,,	,,
1870	,, ,,	712	,,	,,	,,
1875	,, ,,	672	,,	,,	,,
*	* *	*	*	*	*
1890	,, ,,	843	,,	,,	,,
1895	,, ,,	854	,,	,,	,,
1900	,, ,,	738	,,	,,	,,
1905	,, ,,	826	,,	,,	,,

The Army of 1860 then resembled very closely that of 1905 in age composition, the only important difference is in the proportion of men in the two lower age groups, as below :—

Under 20 ..	1860—216 per 1,000.	1905—304 per 1,000
,, 25 ..	,, 627 ,,	,, 656 ,,

Between these extremes, 1860 and 1905, the Army in the United Kingdom was to 1875 of increasing average age, and after 1890 of decreasing age.

These data regarding age composition relate to the Army in the United Kingdom alone, roughly half the total strength. The Army in foreign stations, and especially in India, is on the whole slightly older than in the United Kingdom, if only from the fact that practically the whole of the recruiting occurs in England. But the age of the whole Army, at home and abroad, has on the whole varied concurrently, and the changes observed in the United Kingdom may be taken as indicative of similar changes elsewhere.

(*c*) *Changes in the Conditions affecting Invaliding.*—One definite change has been made during the period: that is, the procedure introduced in 1903, whereby every man in whom tubercular infection is proved to exist is immediately invalided from the service, *i.e.*, struck off the active list, though not necessarily removed from treatment. This, of course, must act in two ways; it increases the loss by invaliding, as a man who is recognised as infected can no longer complete his term of enlistment, as was possible under earlier conditions, and on the other hand it decreases the loss by death, as the cases are struck off the active list before a fatal result ensues. Further, it probably tends on the whole to reduce mortality, as the earlier recognition takes place the earlier the treatment, and the more favourable the prognosis. It is, however, too early to form any definite opinion as to the final effect of this change, an effect which requires time for its full development.

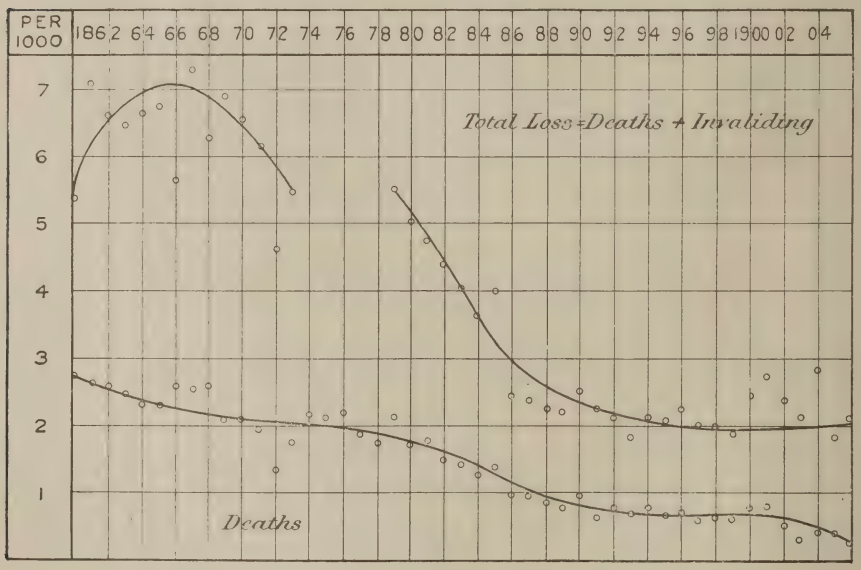
Other changes in the conditions cannot be defined; they have varied from year to year, and from place to place, according to the standard of opinion of the profession generally, and of those officers who individually dealt with the cases. Changes due to alterations in the normal professional opinion are the more important; they are, however, more likely to be manifest over long periods. Variations in the individual opinions affect shorter periods, but are in the aggregate less important. The combined effect of these changes can only be recognised as existing and affecting the various ratios, but their trend and degree cannot be estimated. It is, of course, obvious that any diminution in invaliding, not due to a diminution in prevalence of disease, but to changes in procedure, will tend to increase the death-rate, and *vice versa*. Hence, by taking the total loss by death and invaliding combined instead of the separate ratios, the error due to these ill-defined conditions is lessened.

Dealing first with the morbidity, mortality and total loss in the Army in the United Kingdom, for which the age grouping has been obtained, we find that at various periods the ratios per 1,000 of strength were as follows:—

Years	Admissions	Deaths	Cures	Total losses
1859-69	11·36	—	—	9·23
1879-84	9·7	2·08	3·80	5·88
1881-90	3·7	1·05	1·75	2·80
1886-95	3·4	0·90	1·70	2·60
1891-1900	3·2	0·68	1·70	2·38
1896-1905	3·1	0·56	1·71	2·27

The third, fourth, fifth and sixth periods overlap the preceding periods so that a smoother progression is obtained. The sudden fall from the second to the third period shows some important alteration in the early part of the decade ending in 1890, and since that date the improvement has been steady. The change in the early eighties coincides with an alteration in two factors, the age of the Army, and the condition of the barracks ; the relative importance of each of these will be considered later.

More exact information concerning mortality and total loss in the whole Army, at home and abroad, is given in the attached diagram, prepared from figures which have been compiled by



Lieutenant-Colonel Melville, R.A.M.C., and kindly lent for the purpose of this article. The upper curve relates to the total loss by death and invaliding, the lower to deaths alone. To eliminate variations of short period, which are difficult to explain, which also obscure the general picture, freehand curves have been drawn approximating to the actual observations, but these observations have themselves been plotted as small circles, so that the approximate accuracy of the generalised curve may be criticised.

It is evident at a glance that the diminution of the mortality has been practically continuous. From 2·78 per 1,000 in 1860 it has fallen to 0·28 in 1906, and there are no important breaks in the

steady improvement. Between 1866 and 1874, both rates are considerably disturbed, but it is not now possible to explain this. Again, during the period of the war in South Africa there was a slight disturbance associated with the abnormal conditions prevailing during that period, conditions which have no parallel during any other part of the period. There is, then, no great error in assuming the diminution to be practically continuous during the period; the investigation of the causes of the smaller variation is beyond the scope of this paper.

The curve for total loss shows very much greater variability than that for mortality, this increase being, of course, due to greater variations in the number of invalids, always much larger than the number of deaths, and so allowing of larger departures from the mean. Between 1860 and 1866 there was a decided increase; since that date, the trend has been almost uniformly downwards (particulars for the years 1874-78 are, unfortunately, not available), and probably the decrease was uniform, as it was rapid, from 1867 to 1887. About 1887 there is a decided change in the slope of the curve; the diminution continues, but at a much slower rate; and here again, during the South African War, a temporary and comparatively insignificant increase occurred, while the effect of the new procedure introduced in 1903 may account for the slight increase in 1904-06. The variations during 1900-03 and 1904-06 are, of course, not insignificant taken in relation to the preceding decade, but they are of much less importance taken in relation to the whole period; they are the finer details of a large whole.

The results for the whole Army, at home and abroad, as shown in this diagram, agree well with the results given above for the Army in the United Kingdom. About 1885 is the point at which the period of most rapid improvement ceased; since then improvement has been steady but less rapid. That is, of course, what might be expected; when the most important elements in causation have been removed, the elimination of smaller factors can only have a smaller effect on the final result.

There is, of course, no possible doubt as to the reality of the change that has taken place.

II.

Alterations in the Conditions of the Soldier's Life.

Three important changes have occurred during the period.

(1) Alterations in the conditions of enlistment, leading to a diminished average age, as detailed above.

(2) Alterations in the conditions of the soldier's life; improvement in the hygienic conditions generally.

(3) Alterations in the construction of barracks; improved air supply.

The general hygienic conditions have undoubtedly improved, of which valuable evidence is afforded by the diminished prevalence of infectious diseases of all types. In this connection one would specify particularly greater attention to the food and its cooking; the decrease of intemperance, part of a national change; the introduction of a rational system of physical exercises; these, however, have been more important during the later years of the period. Minor changes in equipment and clothing have also had a beneficial effect. A diminution in guards, and especially in the number of sentries, is also an improvement. One should also remember here one specific method of prevention, the prohibition of spitting, which is slowly becoming less frequent. All these factors, however, appear to be but of secondary importance; neither alone nor in combination are they capable of producing any marked change in prevalence of tubercular disease.

The important hygienic factor is undoubtedly an increased air supply. Quite apart from any statistical evidence in this particular case, although, as will be seen, this is the only efficient factor, the whole modern experience in the treatment of tubercular disease shows the very great importance which is to be attributed to it. Increased air supply involves not only the provision of greater cubic space, and almost as important, greater superficial area, but increased attention to the methods by which the air is renewed by ventilation. The conditions about 1860 were in this respect extremely bad, as may be seen from the Report (published in 1860) of the Royal Commission appointed in 1857 to report on the sanitary condition of barracks and hospitals in the United Kingdom. Of the total strength, 76,813 men, only 4,656 had sleeping room exceeding 550 cubic feet, while 34,882, or about half, had less than 400 cubic feet. The minimum cubic space recommended by the Commission was 600 cubic feet, and this has been the regulation allowance for barracks in the United Kingdom for many years. At foreign stations, especially in hot climates, this allowance is increased.

But it is one thing to lay down a minimum, and another to get this minimum used in practice. The Commission pointed out that an increase of about one-third of the barrack accommodation was needed in the United Kingdom, and although gross cases, especially of inefficient ventilation, were dealt with at once, it was

some years before the recommendation of the Commission—the provision of a minimum of 600 cubic feet—could be universally carried out.

Now it has been seen that in the United Kingdom, most of all affected for good or bad by these conditions, the three elements, morbidity, mortality and total loss, showed a sudden change in the early eighties, and that since then the improvement has been at a slower rate. Increased accommodation in barracks, of course, acts in two ways ; it diminishes the risk of infection for healthy men, and assists the infected in combating the disease. Hence, as long as improvements in barrack accommodation were possible, their execution produced a double effect on the infected and the healthy men also, and this effect showed itself, as has been seen, by a rapid improvement. It is probable that this date, about 1885, represents the end of the period in which improvements in barrack accommodation were effective in reducing disease prevalence, and this coincides approximately with the end of the period during which extensive alterations were being made.

With regard to the age factor, it is not possible to assign any important influence to this. As has been seen, from 1860 to 1875 the Army was growing older, while it is during the latter part of this very period (from 1867 onwards) that the rapid diminution in the total loss began. After 1876 the Army again became younger, and from 1879 (when the total loss was about the same as in 1873) the rapid decrease continued at about the same rate till about 1885. So that we have a comparable, if not an identical, rate of decrease in two periods in which the age movement was in opposite directions. The suspension of the decrease between 1873 and 1879 is very probably only apparent ; if statistics had been available for this period, it would probably have resulted that the curve would have shown an approximately constant decrease from 1867 to about 1885.

One is never prepared to admit that any barrack is perfect in construction, and the maintenance of adequate ventilation, even where the means provided are above criticism, is extremely difficult and requires constant supervision. So that it is not possible, and in fact one knows it to be incorrect, to say that nothing remains to be done in this direction. The soldier's natural instinct is to close up all fresh air inlets, and much education is required in this direction. It is therefore not absolutely correct to conclude that the sudden alteration in the total loss curve about 1885 is due solely to the *full* effect of the improvements in barracks having been obtained.

One element which is important in this connection is the effect of the short service system, apart from its influence on the age of the Army. It appears to have been about 1885, as far as one can judge in the absence of numerical records, that the short service system may be assumed to have been completely established. One effect of this was that men with a mild infection of gradual development ceased to serve with the colours before they became physically unfit for their duties, so diminishing the loss by invaliding, and to a less extent by death.

A certain proportion of acute cases will always occur in which the progress of the disease is so rapid that a fatal result supervenes early. That is, assuming the proportion of these cases to be fairly constant, the mortality over a long period is probably a better index of the degree of infection than the total loss, as the mortality rate is less influenced by factors of secondary importance, such as the length of service. But as in the total loss curve, so in the mortality curve, there is a point of inflection about the same period, but a little earlier. That is, on the whole, the two curves are comparable throughout their whole extent, and the conclusions are supported by both.

One mode of prevention has not as yet been referred to: that is, the elimination of the infected at the time of their entry into the service. There does not appear to be any essential difference in this respect between the early and the later years of the period: full attention has been given to this throughout. But there will always be a proportion of cases which are not recognisable by ordinary clinical methods of examination, and this proportion will bear some relation, probably a constant relation, to the prevalence among the general population from which the recruits are drawn. Now, as the prevalence among the general population shows a distinct diminution, it is probable that the proportion of unrecognised cases which are taken into the service is becoming smaller as the general infection decreases. This, however, is not a point of much importance as compared with the other factors.

As about half the British Army is constantly serving at foreign stations, it is of some importance to consider how far the conditions apply to both sections of the Army. In such a country as India, where the high air temperature during a considerable part of the year makes it impossible to have satisfactory ventilation, the conditions are somewhat different. The difficulty of the air exchange is lessened by an increase in the minimum cubic space allowed, and on the whole the history of barrack accommodation in foreign stations has been parallel to that in the United Kingdom.

An examination of the various elements in the prevalence of tubercular disease at the various foreign stations leads to the conclusion that the effect of local conditions on the incidence of the disease, as compared with the United Kingdom, is surprisingly small, while on development—that is, the result as regards death and invaliding—it is even less.

The statistics used here relate to all forms of tubercular disease, but tubercular disease of the lung is by far the most important form both as regards prevalence and progress.

One may summarise the whole discussion in two propositions: (1) There has been a marked decrease in the morbidity, mortality, and total loss during the last forty-six years. This period is divided into two sub-periods, the earlier of rapid decrease, the later of slower. (2) The one element which appears to have been effective in producing the rapid decrease of the earlier portion of the period was increased air supply, including increased cubic space and improved ventilation. The slighter degree of improvement during the later period is due to causes of secondary importance.

Further improvement to any marked degree would appear to be possible in two ways only: (1) Earlier recognition and elimination of cases of tubercular infection, so as to diminish the chances of contagion. In this, Calmette's ophthalmo-reaction will give valuable assistance. (2) Education, not only of the soldier, but of the general population, in all that concerns the prophylaxis of tubercular infection.

AN INVESTIGATION INTO THE CAUSES OF THE PREVALENCE OF ENTERIC FEVER AMONG THE TROOPS STATIONED IN BERMUDA, GIVING DETAILS OF THE MEASURES ADOPTED TO COMBAT THE DISEASE, AND SHOWING THE RESULTS OF THESE MEASURES, DURING THE YEARS 1904 TO 1906.

By Major C. F. WANHILL.
Royal Army Medical Corps.

As is apparent from the study of the Annual Reports for the Army Medical Department during the decennial period 1893 to 1902, Bermuda possessed the unenviable reputation of having the highest enteric fever rate per 1,000 of any Command occupied by British troops. The copy of the table in the Report for the Army Medical Department illustrates this. (See p. 29.)

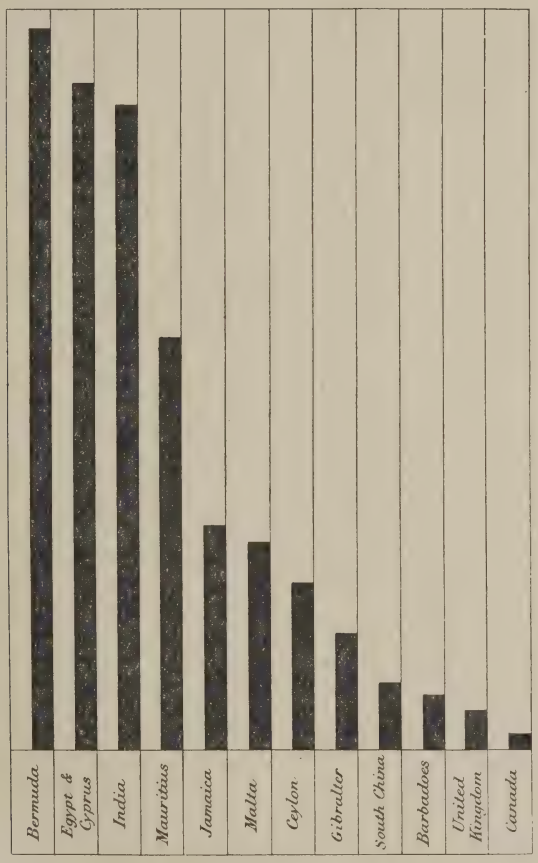
Except as regards enteric fever, the disease rate among the troops on the Islands was so exceptionally low, that if the former disease could be eradicated, or at any rate kept within bounds, there seemed no reason why Bermuda, as a military station, should not be rendered exceedingly healthy.

On my appointment as the first Sanitary Officer in the Islands, I quickly realised that my obvious duty was to inaugurate a campaign against the only disease of importance then existing. As a preliminary it was necessary to cultivate a thorough acquaintance with the Islands, the military stations and camps, their water supply and conservancy arrangements generally, and, incidentally, on account of the neighbourhood of the civil population, to make a careful study of their habits and the conditions under which they lived. This of necessity required time, as unless the knowledge acquired was thorough, measures which might be formulated were liable to be made abortive by unforeseen circumstances.

Geographical.—The Islands consist of seven large areas, mostly connected by bridges, and of numerous smaller portions, ranging in size from a few acres to mere rocks, the whole being spoken of as the Island of Bermuda. Practically, the seven large islands alone are of importance, as they contain the bulk of the population. The estimated area of the Islands is approximately 19 square miles, and the population numbers about 19,000.

Geological.—The Islands are composed of disintegrated coral in the form of coarse sand, which is cemented together by the deposi-

tion of carbonate of lime dissolved from the upper strata and deposited by water which has percolated through. The rock consequently has a tendency to harden under the action of the water in a manner similar to cement. As a consequence of this porosity no natural sources of water supply occur on the Islands, except where, near the sea, brackish water may be found floating on the



surface of the sea water. A red soil, the result of disintegration of the sand, is spread in patches over the Islands. It is exceedingly fertile and is extensively manured, a circumstance which does not tend to improve the character of the ground water.

Meteorological.—The average annual temperature is fairly high, although the maximum rarely exceeds 87° F. The excessive humidity renders the climate very trying to Europeans. The annual rainfall

varies from year to year, with an average of about 54 inches. It is distributed over the whole year, there being no definite rainy season, the dryness of the summer months being broken by periodical heavy downpours and thunderstorms.

Water.—All water supplies are collected from the roofs of houses or from cleared spaces on the hillsides rendered impervious with cement, and are stored in over- or under-ground tanks.

Military Stations.—The Garrison is divided between three permanent stations, Prospect (the headquarters), St. George's and Boaz. In Prospect are included the musketry camps at Warwick, and an overflow camp at Whale Bay; in St. George's the forts at St. David's Island, and in Boaz the forts at Ireland Island and Somerset. There are also three signalling stations at which small detachments are kept; Agar's Island, the old magazine, is now abandoned.

Civil Population.—The civil population is collected chiefly in the towns of Hamilton and St. George's and on the Island of Somerset; but owing to the agricultural pursuits of the inhabitants, it is scattered, more or less thickly, over the whole of the islands. It is therefore always in intimate contact with the military garrison. The inhabitants of the islands consist of the descendants of Europeans, practically unmixed with the coloured population. The latter form the majority of the people; they are, with the exception of a few aliens, generally on a higher plane of civilisation than the West Indian populations, and are consequently much more amenable to sanitary influences.

Civil Sanitary Organisation.—Sanitary matters are presided over by a Central Sanitary Board, of which the Principal Medical Officer of the Military Forces and the Senior Naval Medical Officer stationed on the Island are *ex-officio* members. There is also a Medical Officer of Health who devotes his whole time to the work and is a member of, and acts as sanitary adviser to, the central authority.

Each parish has its own Sanitary Committee, which carries out the work of the parish under the supervision of the Medical Officer of Health. The sanitary organisation, therefore, of the Islands is complete, but the efficiency of control is hampered by the comparative poverty of the majority of the population and by conditions similar to those which exist in most of the rural and urban districts in Great Britain.

Summary of the Cases of Enteric Fever which occurred during the Years 1904, 1905, and 1906.—On arrival at Bermuda in March,

1904, it was found that a few cases of enteric fever had occurred in Warwick Camp, among the men of a regiment which left the island by the same troopship. The regiment was replaced at Warwick and Boaz by the 3rd Battalion of the King's Royal Rifle Corps.

At Warwick cases of enteric fever began to appear among the men of this battalion in September and continued till the end of the year, some seventeen cases in all being admitted. From Whale Bay Camp four cases were admitted from the same battalion. On the return of some of the companies to Boaz the epidemic continued there, nine cases in all being admitted, making a total of thirty cases in all.

Among the men of the 3rd Battalion of the Royal Fusiliers and of the Royal Engineers, stationed at Prospect, no cases occurred till September, when three men of the latter corps were admitted with the disease, followed after an interval by twenty-four men of the Royal Fusiliers, the epidemic ceasing about the middle of December.

At St. George's only one case occurred during the year, and this was traceable to outside sources.

During 1905 no cases were admitted from Whale Bay Camp, and only one case occurred at St. George's.

At Prospect seven cases occurred. At Boaz, the 3rd Battalion of the King's Royal Rifles suffered severely, twenty cases occurring, while among the rest of the regiment, stationed at Warwick, no cases occurred.

During 1906 there were four cases at Prospect, one at Warwick, one at Boaz, and four at St. George's.

Water Supplies for the Use of Troops.—The water supplies were naturally first brought under review, as being the most likely agents for the dissemination of enteric fever; and during the three years constant investigation as to their condition was carried out, both by chemical and bacteriological methods, and by constant personal inspection of every tank and water-catchment area in the Islands, belonging to the War Department.

The number of military tanks on the Islands is very large; and although in some cases the tanks are in communication by means of their overflows, it may be taken that no common water supply for the troops exists, except perhaps at Warwick Camp, where one catchment and tank supplies the North Camp and one the South. Only in these camps was it possible to watch the effect of the water on the health of the troops, and, except for the slight outbreak of diarrhœa, which may not have had anything to do with the water, no ill-effects were ever observed.

Chemical examination of the water was soon given up, being useless, as it was practically distilled water to which organisms had been added, while bacteriological supervision was also impossible on account of the very large number of separate tanks and the change in composition of their contents after every rain.

Dust from manured land was constantly present on the roofs and catchment areas, being washed into the tanks every shower, no separators being provided. Coliform organisms might thus be expected to abound in all the water supplies, and this was amply borne out by the results of such bacteriological analyses as were made. Repeated attempts were made to see if it was possible to isolate *Bacillus typhosus* from water, but, as might be expected, without success; and no evidence was ever discoverable which could be held to point to the water supplies as agents in the conveyance of enteric fever. Failing chemical and bacteriological supervision, inspection of all tanks and their surroundings was the only practical method of safeguarding the waste supplies.

Conservancy.—Two systems of sewage removal existed side by side in the military stations in the Island. In St. George's, Boaz and Prospect the water-carriage system was installed; while in Warwick and Whale Bay Camps, and in all the isolated quarters at all stations, where the distance was too great to connect up with the sewer, the dry-earth system survived.

At Boaz and St. George's the flushing water was provided by the pumping of sea water; but at Prospect, 180 feet above sea-level, the fresh-water stores had to be utilised for this purpose. This supply was inadequate to the needs of the large number of troops stationed at the post during the whole year, and a recommendation was put forward for the increase of the catchment areas and tanks, to meet the demand. As, however, the garrison of the Island was reduced to one battalion the following year, the scheme was abandoned, the quantity available approximating more nearly to the needs of the reduced garrison. In the event of fire, however, the barrack fire hydrants, which also depended on the fresh-water tanks for their supply, would soon exhaust the available water.

The Jennings trough pattern latrine was in general use by the troops, and may be regarded as quite unsuited to the needs of Bermuda. In a trough full of water, and in which, on account of the scarcity of water, flushing can only be carried out two or three times a day, fæcal material accumulates and floats, affording, with the soiled paper, a good foothold for flies. Consequently, in a country where flies abound these latrines should be flushed seven

or eight times a day, or wash-down water-closets should be used. The comparative immunity of St. George's from the disease at a time when Prospect was suffering severely can only be attributed to the fact that there was a plentiful supply of sea water available at the former place, while at the latter, owing to the drought and to the excessive number of troops using them, the latrines could not be kept properly flushed. In 1905 the access of flies to the troughs was prevented by the provision of covers to the openings in the seats of the latrines, ventilated by the insertion of a piece of perforated zinc in the centre and so constructed that they fell into position the moment the seat was vacated.

The dry-earth system of removal was carried out by local contractors and was performed in a manner usual in enervating climates, requiring constant supervision. Still it was found that, when once the local conditions were understood, and the service was carried out properly, less enteric fever occurred where the dry-earth system was in use than where water carriage was installed. In Warwick camp, when the defects in the system were remedied, no further cases of enteric fever occurred; and in the isolated quarters, where the system was almost universally installed, no cases occurred in the three years under review. The inference, therefore, is not that the dry-earth system is preferable, but that, if properly carried out, it is infinitely less dangerous than an inadequate water carriage system.

As regards comestibles meat was supplied to the troops by a contractor who imported cattle and practically monopolised the wholesale trade of the Island. The slaughter-houses were kept under strict supervision and were invariably in a clean and sanitary condition. The same contractor supplied all the ice as a part of the cold storage business. As all water for making ice has to be boiled to expel air in order to ensure a clean ice, no danger could be traced to this source. There were several mineral water manufactories from which mineral waters were obtained for the use of the troops. These were kept under strict supervision and defects pointed out. As a rule, suggestions were well received by the manufacturers and, if feasible, carried out. No cases of disease were ever traced to the products of any of the supervised factories.

The general conditions under which the troops lived having been investigated, it became necessary to sift the evidence afforded by the way in which the disease arose, with a view to obtain clues to the causation of the disease. The incidence of the cases in the various camps seemed to give a hint as to the probable origin of

the epidemics, but in the case of each camp the indications differed according to the varying conditions which prevailed.

From the summary of the history of the outbreaks already given, it will be seen that in Warwick Camp there was a probability that the camp was infected by the regiment which left the Island in 1904, or that the conditions which facilitated the spread of the disease were still in existence. As, however, no cases occurred among the fresh troops until six months after their departure, the theory of direct infection seems doubtful.

The conditions which might assist in starting and spreading the disease may be summarised as follows :—

(1) A defective or infected water supply.
(2) Insanitary conditions in the camp itself.
(3) Infection from the civilian population.
(4) Other causes not indicated directly by the facts available.

Taking the first of these conditions, the water supply of the two sections of the camp was collected in a large tank, in each from a catchment area immediately above it. This area was liable to contamination with dust from the camps, but it scarcely seems probable that *B. typhosus* would be able to survive the exposure to the sun's rays to which it must be subjected on a whitewashed area of bare rock, but thinly sprinkled with dust, until a shower should wash it into the tank.

As no interference with the tank or any part of the apparatus attached to it was allowed, there seems no reason to suppose direct infection by the troops was possible. The immunity of the troops during the dustiest part of the year, when occasional heavy showers prevailed, seems to absolve the water supplies of complicity. The fact that for the two following years, after other defects had been remedied, no cases of enteric fever occurred, the water supply not having been interfered with, seems to decide the matter.

Taking the condition of the camp itself, it was soon discovered that it was in a far from satisfactory condition. The camp was divided into the so-called old and new camps, separated from one another by a field some 200 yards across, with several high hedges of oleanders. The 3rd King's Royal Rifles occupied the old, or windward camp, while a detachment of the 3rd Royal Fusiliers occupied the new camp. All the cases, with one exception, occurred in the old camp, and this at once pointed to some condition prevailing in one camp and not in the other. The number of troops in the old camp was greatly in excess of that in the

new, despite the fact that the area of the latter was much greater than that of the former. The latrines were also of a bad pattern, the seats were insufficient in number for the troops present, and the use of dry earth to cover fæcal matter was neglected. As a result, the pails were full to overflowing early in the morning and were exposed to flies for the rest of the day, since by the law of the Island they were only allowed to be emptied at night. The resultant condition of things can be well imagined; and of the possibilities of food contamination there could be no doubt. In the new camp, owing to the smaller number of troops, matters were not so urgent, and the greater distance of the latrines from the tents prevented the carriage of infection.

The danger of civilian infection was undoubted, as on one or two occasions the commencement of an attack was directly traceable to the drinking of water, from native houses, by men carrying out field-training. This, however, though accounting possibly for the introduction of the disease into the camp, could not be blamed for its continuance.

As regards other factors tending to the spread of the disease, the questions of food and drink have already been disposed of. The practice of eating and keeping food in the tents must be blamed for, at anyrate, affording facilities for the spread of the disease by attracting flies which had but lately arrived from the latrines. The dangers of infected dust were also accentuated by this practice.

The precautionary measures necessary, therefore, resolved themselves into a campaign against flies. The number of latrines was doubled and they were altered to a more sanitary pattern. All were built on a concrete base, so arranged that all spillings, either by the men or by the contractor who emptied the buckets, were retained on it, and were prevented from soiling the ground. These bases were washed down twice a day, the soiled water flowing into a channel and from thence to a covered soakage pit, from which disconnection was secured by a trap. The urine from the urinals, instead of remaining in buckets all day, was also conducted into these pits. The porous nature of the soil ensured the prompt removal of all such liquids. The use of dry earth, in a manner which left nothing of interest to the fly, was insisted on, suitable earth-boxes and scoops being provided. While the extra latrines were under construction leave was obtained from the Medical Officer of Health for the emptying of the buckets twice daily, doubling at once the capacity of the latrines. The doors and windows of kitchens and of all places where food was kept were fitted

with perforated zinc in frames, and these were made self-closing. The destruction of chance flies was arranged for by fly-papers. All food sold in the canteens was covered with gauze, stretched on wooden frames, so arranged that the gauze could easily be detached and washed. Kitchen refuse and soiled water were also disposed of in a manner which prevented the access of flies. Chloride of lime was issued for the purpose of discouraging flies, and was found of great use. A large hut was set apart for the men to have their meals in, and arrangements were made for the storage of all bread or other food in boxes made fly-proof with gauze. On account of the dangers of ice-cream, as made locally, an apparatus was purchased by the regiment and the cream sold in the canteen.

In addition to these measures lectures were given to the troops to accentuate the importance of the observance of sanitary rules. Careful supervision of all native and other hawkers was also arranged for; but owing to the camp being surrounded by woods this was difficult to carry out, and the fact that the men would be at liberty to purchase any kind of unsupervised article, when walking out, rendered the supervision of little use.

As will be noticed from the short history given previously, the result of these measures was the complete disappearance of enteric fever from the camps for the next two years.

While on the subject of the dry-earth system, it may be well to consider the defects discovered in the management of it throughout the Island and the measures taken to remedy them. It was found that the contractors for the removal of night-soil all over the Islands failed to cleanse the buckets properly before returning them, thus providing a foul surface covering the inside and outside of the buckets, for flies to crawl on. By the contract, which had not been altered since the whole of the troops had been served by this system, the contractor was supposed to wash the buckets on the spot, water being supplied near the latrines for this purpose, and the soiled water being emptied into the carts carrying the night-soil. This method was considered inadvisable for the following reasons :—

(1) The carts provided by the contractors, having to be of light construction to surmount the steep gradients to the various quarters, were never water-tight.

(2) With native workmen it seemed much more likely that most of the soiled water would be thrown on the surrounding ground.

(3) Water from the tank supplying the house with drinking water was only available in limited quantity at detached quarters,

and it was not considered advisable that the workman should be allowed to soil the pump-handle with material gathered from the soiled pails.

After consultation with the contractors it was found that they were willing to allow the insertion in the contract papers of the words "in the sea," after those "properly washed." This at once settled the whole difficulty, no objection being raised by the local sanitary authorities, and where access to the sea was difficult or dangerous, platforms were built from which the bucket contents could be thrown into deep water, and pumps were provided to enable the buckets to be washed out. As night-soil itself has a certain manurial value, the disposal of it in the sea was not insisted on, burial being allowed at a distance of not less than half a mile from all military buildings, and in accordance with the requirements of the civil authorities. Care was also taken that the fresh earth supplied to the quarters was virgin soil and had not recently had excreta deposited in or on it.

Moule's pattern closets were almost universally used in married quarters. These closets work in a satisfactory manner as long as the earth supplied is dry, but choke at once with wet earth or stones. They require a small amount of care to keep them in proper working order, which, it is to be regretted, they did not often receive.

Enteric Fever in Prospect Camp.

The course followed by an outbreak of enteric fever in Bermuda was usually as follows: (1) Introduction of the disease into a station from another station or from the civil population; (2) infection of the troops, from the first case, or from "carriers": by personal contact; by flies from the latrines; by the use of infected vessels, &c.

The sequence of events was as follows: (1) The admission of a man to hospital with symptoms pointing to gastric disturbances and a slight rise of temperature; (2) the admission of a case or two from the same room, often with undoubted symptoms of enteric fever; (3) the admission of men from all over the barracks with the disease.

The outbreak in 1904 succeeded in obtaining a firm hold before the conditions governing it were appreciated. A Royal Engineer was admitted from the Engineers' block on September 3rd, and two other cases from the same room on the 12th and 13th respectively. As the work of these men took them all over the Island they had

more opportunities for contact with the civil population than other soldiers, and hence the probable infection. The Royal Engineers' latrine was in the immediate rear of the cookhouse, and as the first man used this, the way in which the other men were infected was not difficult to imagine. From this latrine it was possible for flies to reach the regimental cookhouse, some fifteen yards away, and also the barrack blocks close by. As a result a cook from this cookhouse was admitted to hospital with the disease on the 24th. From the barrack block next to the Royal Engineers block three cases were admitted on the 22nd, 24th, and 26th, which might have been due to food infection or to the Royal Engineers' latrine, which, being close by, they probably used. A small outbreak also occurred in the band block, at the other end of the barracks, which may have been due to the fact that the adjacent latrine, in addition to being cracked at that time, was also the worst supplied with water in the whole station. Two other cases, a man working in the butcher's shop and a pioneer, whose occupations kept them in the vicinity all day, may have been due to the same cause, as they used the same latrine. As regards the later progress of the disease, several men were found to be ambulant cases. They had been sent to hospital early in the outbreak, but their symptoms subsiding rapidly, they were discharged to duty. They were either admitted to hospital with definite attacks of the disease later, or were placed in the isolation camp.

As the water supply was practically a common one, being, on account of the shortage, brought to the cookhouse in carts and thence distributed to the men, it cannot be regarded as the source of the infection.

From this outbreak the following deductions were made: (1) That the disease had been introduced into the camp, probably from the civil population; (2) that the cause of the spread was the infected latrine, through the agency of flies, &c.; (3) that the generalisation of the disease in the barracks was due to ambulant cases and to infection left by the men already admitted to hospital.

The establishment of an isolation camp for the segregation of ambulant cases, carriers, or convalescents, brought about a rapid cessation of the epidemic.

Years 1905 *and* 1906.—Owing to the following out of the plan of campaign to be described shortly, there were very few cases of enteric fever in Prospect during the years 1905 and 1906. Usually the patient gave a history of contact with the civil population of a low class, or he came from a room in which a previous case had

occurred. The occupations of the men, mess waiters, officers' servants in outlying quarters, and the alcoholic tendencies of at least one, amply accounted for the way in which the disease was contracted.

The measures taken were as follows :—

(1) All sick at Prospect were seen by the sanitary officer, and any man suffering from headache, a rise of temperature, diarrhœa, and foul tongue, was at once sent to hospital for observation.

(2) The belongings of such men—kits, bedding, &c.—were sent to hospital for disinfection. This was insured by the words "kit and bedding to hospital," being written against the man's name across the sick report, which was sent to his company officer. The whole of these articles (leather, of course, excluded) were placed in the Thresh disinfector.

(3) The men of the barrack-room to which the patient belonged were confined to camp, not allowed to use the regimental institutes, and were made to use a special latrine which was carefully supervised. A Soyers' stove was kept full of boiling water, and into it all utensils used for food or drink were placed, before being allowed to go to the cookhouse again. Beer and minerals from the canteen were allowed to be consumed in the barrack-room, but all glasses, &c., were boiled before being returned.

(4) The men under observation attended all drills, &c., but went on guard together, and took their own blankets and bedding with them.

(5) They were inspected daily for thirteen days, or until the man in hospital was pronounced not to be suffering from enteric fever. By this means the disease was usually limited to the first case.

Enteric Fever among the Civil Population.

As the blame for the introduction of the disease into the military stations is constantly being laid on the civil population, it may be well to justify this here. There seems no reason to doubt the fact that enteric fever in a mild form exists among the coloured population much more than is generally thought or acknowledged. When it is considered that the drinking water supplied has for centuries been drawn from tanks connected with the roofs, and that the standard of sanitation has been, and still is, low, there is little reason to doubt that enteric fever must also have existed for long periods. As in Cuba, where the inhabitants have acquired an immunity from yellow fever, and consequently only suffer from mild forms of the

disease, so it is conceivable that in Bermuda an immunity from enteric fever has been acquired in a similar manner. Newcomers in both islands are liable to attacks of the disease in no way differing from the typical attack.

During certain periods of the year mild fevers are prevalent in Bermuda which are not malarial, as the parasite has never been discovered and the necessary mosquito does not exist, and there seems no reason to doubt that these fevers are mild attacks of enteric fever. No specific fever, except enteric, has ever appeared among the troops; the inference being that no others occur on the island. (Since writing this a few cases of beri beri have occurred.)

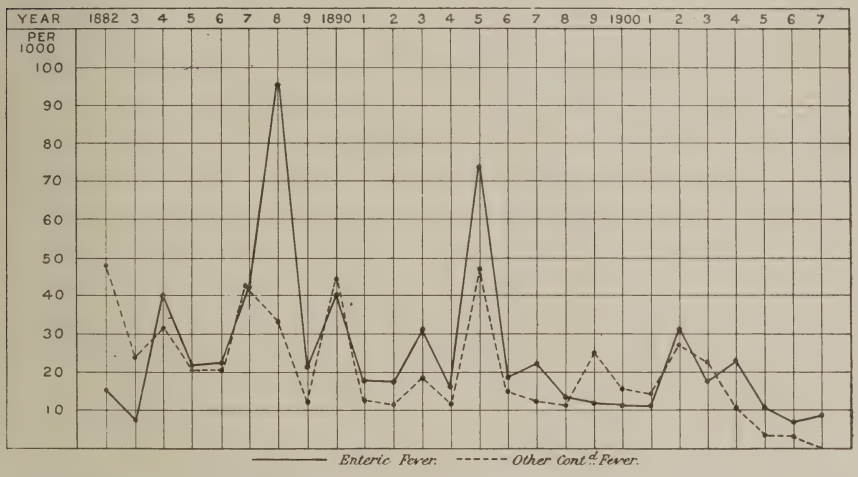
As we know that the protective influence of one attack of enteric fever wears off gradually, the mild attacks may be due to the immunity being insufficient to ward off the attack, but like vaccination, being able to mitigate its virulence. It should also be noticed that the disease is increasing considerably among the whites; whether owing to better diagnostic methods or to the influx of non-immunes it is hard to say.

That many cases of enteric fever among the civil population escaped diagnosis or were not reported is well known to Service medical men, and considering the poverty of the coloured element, the inferior knowledge of the native medical men who attend them, if called in, and the difficulty, even when equipped with the best knowledge on the subject, and with an up-to-date laboratory, of being certain of the origin of a mild fever, it is not surprising that many more cases should exist than are brought to notice.

Boaz.—The outbreak which occurred in 1904 was, undoubtedly, a continuation of the epidemic at Warwick Camp, as has been stated before, and died out as soon as the infecting persons were removed to the convalescent camp at Fort Hamilton.

An isolated case, however, which occurred earlier in the year, illustrated the danger to the troops owing to the propinquity of the civilian population at Somerset. The man was a sapper, who was employed on work around the Island. He was in the habit of having his tea in a small restaurant in Somerset. As soon as the occurrence of the case was notified enquiries were made as to the man's movements, and this restaurant was examined. It was found that, while attending to the shop and dispensing the food, the proprietor was attending her daughter who was suffering from enteric fever in the rooms above. She also acknowledged that she was in the habit of leaving a bedpan containing her daughter's

stools in the verandah, immediately over the shop, all day or until she could dispose of them in the dry-earth latrine. No covering was used, and there was nothing to prevent the access of flies which, in a shop where pastry was kept, would be very numerous. The tank, from which all water was drawn for the house, was situated under the floor of the shop, which formed its roof. The jointing of the floor was by no means tight, and dust from the floor could find access to the tank. The latrine and urinal were at the back of the house, against the cliff, and on a slightly higher level than the water in the tank, so that material which did not fall into the buckets in either place could be washed into the tank



Admissions for Continued Fevers in Bermuda Garrison per 1,000 of strength, showing the relation between Simple Continued Fever and Enteric Fever from 1882 to 1907, and how the causes tending to prevent the latter have also eliminated the former.

by heavy rains, the porous sandstone walls of the house or tank being no obstruction. The daughter was attended by a native medical man, who, if he had diagnosed the case, did not notify it to the Medical Officer of Health till the investigations commenced, and who took no trouble to safeguard others against infection, either by giving the mother instructions or by disinfecting stools, &c. As a result, the sapper contracted enteric fever and died, while the woman's own son, who was in the Navy, was admitted into the naval hospital with the disease, but recovered. How many cases occurred among the civilians as a result of

this case it is impossible to say, but there is no doubt that such a focus of infection would be responsible for more than the two cases recorded. This case is given in detail to indicate the conditions which cannot be regarded as existing in this house only, and which amply justify the accusation made against the civil population of being the *fons et origo* of enteric fever in the Islands.

The outbreak which occurred in 1905 is discussed in detail, as it seems to furnish proof of the fact that the disease is conveyed by personal contact from one man to another. On June 14th, 1905, a soldier, employed as waiter in the officers' mess, was admitted to hospital suffering from a mild attack of the disease, confirmed by Widal's method. He first felt ill on May 24th, after a bicycle ride to and from Warwick Camp, where there were no cases of enteric; having had, as he stated, something to drink in Somerset. On June 26th the colonel of the regiment, who was living in the mess, was admitted with the disease, having been unwell for some time previously. Next day, and on the next day following, two other officers were attacked, one of whom had been living in the colonel's house. On the 27th the mess serjeant was also found to be suffering from the disease, having been ill for a week. A further case, a soldier, who had been employed casually in the mess as a waiter since June 14th, was also admitted on July 7th. There thus appears to be a regular sequence of cases, all traceable to a first case, and in such a manner that only contact with food and utensils handled by the first case could account for a number of persons in such different ranks being attacked. Following this other cases occurred, scattered about the barracks, but in such a manner that no cause could be traced, except that the men all messed together on the restaurant system.

In 1906 only two cases occurred. The first was a coloured militiaman, who had contracted the disease in civil life, and the second was the Royal Army Medical Corps orderly who nursed him.

St. George's.—One case only occurred each year at St. George's. In 1906 four cases occurred, two of which were men of the Royal Garrison Artillery, who had recently returned from Ireland Island, where a number of cases had occurred among the sailors of the Royal Navy. One case occurred in the band of the Hampshire Regiment, and the Royal Army Medical Corps orderly who nursed him also contracted the disease.

General Scheme of Precautionary Measures taken to Prevent the Spread of the Disease.

The precautions with regard to the water supply have been already indicated. The manifest impossibility of maintaining a bacteriological or chemical supervision of all the water-tanks rendered visual methods the only ones applicable. That efficient supervision was able to prevent contamination of the water is shown by the fact that in no case was it possible to trace disease to it. The danger of introduction of the disease from civil sources has been already discussed, and further proof on the subject seems superfluous. It was, however, necessary to discover the avenues by which the disease could be introduced, and to devise means to stop them. As it was impossible to prevent men from leaving their stations, there seemed a possibility of safeguarding them when in contact with the civilians, by ascertaining the condition of the public-houses and small restaurants they were in the habit of frequenting, and of having the defects in sanitation remedied. With this view the assistance of the medical officer of health was obtained, as the measures proposed would encroach on his preserves, and a scheme was prepared by which, under the orders of the Commander-in-Chief, all public- and eating-houses, which at a certain date did not possess a certificate from the medical officer of health or the sanitary officer, stating they were in a reasonably good sanitary condition, and were not likely to be prejudicial to the health of the troops visiting them, were placed out of bounds for the visiting troops.

As the chief support of the public-houses was afforded by the troops, the placing of a house out of bounds meant a very serious loss to the proprietor, and was a powerful lever in inducing him to remedy any defects which were pointed out. In order to render the blockade effectual, the system was applied in the first place to Hamilton, and an extra force of police was drafted in to ensure bounds being kept. St. George's and Somerset were dealt with in succession in a similar manner.

It was found that practically all such public-houses had carried out recommendations made within a few months from the issue of these orders, to the great benefit of the civil as well as the military population.

All certified houses were inspected every two months to ensure the maintenance of the standard; and, further, the proprietors of such houses were directed to report, at once, for investigation, any cases of illness occurring on their premises. All places where

articles of food and drink were prepared, which might be supplied to the soldiers, were also supervised. Thus the mineral water factories were constantly inspected and defects remedied. In the case of any opposition being encountered, it was found possible to make the person see the error of his ways as, although he might not supply the troops direct, he did so through some of the public-houses over which the orders previously referred to gave a hold. The civil population of the Island, also, had sufficient regard for their health to be shy of mineral waters from a factory which did not meet with the approval of the civil or military sanitary authorities. Stringent rules were drawn up for the regulation of ice-cream making. As the cream must be boiled before freezing, it is liable to contamination only while cooling or when stored. It was therefore considered that if these processes could be properly conducted there would be little danger of infection. The regulations were framed to ensure this, and only those persons who had premises which were in good order and who seemed likely, from their habits and intelligence, to carry out the instructions, were allowed to supply the troops in any way. Lectures were constantly given to the men, pointing out the risk they ran if the rules were evaded, and also to enable them to exercise an intelligent supervision over their own health. The moral of the lectures was supplied by the eight deaths from enteric fever which occurred in 1904.

Laboratory Work.

The laboratory material was not available till the year 1905; consequently the valuable work which might have been done during the epidemic of the previous year was lost. Besides the water supplies, the milk for the hospitals was examined every month, and the dairies were supervised.

Pure cultures of *B. typhosus* were isolated from the spleens of men who died of enteric fever, and in a few cases from the blood and stools of the living. These, with a culture obtained from the Royal Army Medical Corps laboratories, and one from New York, were the strains used. It was found that the strain isolated one year did not react well the next year, but that every year a fresh culture had to be isolated. The English and New York strains also did not give Widal's reaction till they had been in the Islands for a year. This seems to indicate that there was a slight difference between the strains causing the disease at home and in Bermuda, and also between those producing the disease each year.

Widal's reaction was relied on to back up the clinical symptoms in cases of suspected enteric fever, and several presumed carriers were discovered during the first year. It was thought to be fairly conclusive proof of the necessity for isolation if Widal's reaction was persistently given by a suspect, when all other causes of acquired immunity were excluded.

The opportunities for research, however, tended to disappear as the results of the sanitary precautions began to make themselves felt, the cases of 1905 and 1906 being too few and too sporadic to enable any sequence of events to be established.

Conclusions.

From the facts already given it may be assumed that :—

(1) The chief source of infection with *B. typhosus* in the garrison in Bermuda is the contact of the military and civil populations, and that until this source can be eliminated, cases of enteric fever will constantly arise among the troops.

(2) That it is possible, by rigorous sanitary precautions and by the co-operation of all branches of the Service, to limit cases of enteric fever to those introduced from local sources.

(3) That the danger of personal contact exceeds that from properly supervised water supplies and conservancy systems, and that this danger is aggravated by the mild form which the disease seems to assume in Bermuda.

LACTIC ACID BACILLI—THE RELATIVE ADVANTAGES OF COMMERCIAL LIQUID AND SOLID PREPARATIONS, THEIR MODE OF ADMINISTRATION, AND THEIR EFFECT ON CERTAIN PATHOGENIC AND PUTREFACTIVE ORGANISMS.

Preliminary Paper.

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Commercial Liquid Preparations.

We examined preparations sent to us by Messrs. Oppenheimer and Son, London, and Messrs. Millet et Veillard, Paris. The former is retailed as a semi-fluid "clot of milk," in a sterile glass vial; the latter in the form of a malt extract. Both of these preparations contain a bacillus in pure culture, whose morphological and cultural characters are identical with those of the Bulgarian bacillus of Grigoroff, described by Massol and Cohendy. It is an immobile rod, varying in length from 2 μ to 20μ, somewhat similar in appearance to the anthrax bacillus, but differing from it in being non-sporing. In cultures it grows in pairs or in chains. The bacillus retains the stain by Gram's method in preparations prepared from living cultures, but it fails to do so in cultures which have been desiccated or heated to 65° C. It does not liquify gelatine, and grows but feebly on ordinary laboratory media at 37° C., or at room temperature on any media. It grows abundantly both aerobically and anaerobically in slightly acid whey, sterilised milk, and glucose media at 37° C., but ceases to grow when the acidity of the media exceeds 2 per cent. It ferments lactose, glucose, and maltose readily at 37° C. Its action on sucrose, mannite, and dulcite is less marked, and only appears after several days' incubation. The acid-producing qualities are much greater than those of other lactose fermenters found in solid lactic acid bacilli preparations. The difference is marked after twenty-four hours' incubation at 37° C. No contaminations are found in these preparations.

Commercial Solid Preparations.

We received from Messrs. Allen and Hanbury a sample of their tablets of sauerin; from Messrs. Parke, Davis and Co., lactowe

tablets; from W. Martindale, trilactine tablets; from the Anglo-American Pharmaceutical Company, fermenlactyl tablets; from the Société le Ferment of Paris, lactobacilline tablets; and from the Laboratoire de Biologie, Paris, a preparation of lacteol.

At first sight, these tablets appeared to be most advantageous, on account of their portability and their moderate price. Subsequent examination, however, showed that in every case contaminating organisms were present. In most of the preparations examined we noted the presence of an impure culture of Bulgarian lactic acid bacilli, some of which failed to stain by Gram, or to reproduce themselves in subcultures, and were regarded by us as having been killed by desiccation. The subcultures contained at first living Bulgarian bacilli, but in most cases these were quickly overgrown by other Gram-staining and non-Gram-staining organisms. The type of organism which predominated in subcultures on sterilised milk, and on Cohendy's whey medium, was a sporing Gram-staining rod. It appeared to be identical with a form of butyric acid bacillus.

The presence of these contaminations was not accidental, as they were found in every subculture made on milk sterilised by heat for one hour on five successive days. We noticed, in addition, varying numbers of micro-organisms, some of which fermented lactose and clotted milk, and others which failed to do so. Their presence appeared to inhibit the growth of the Bulgarian bacillus. Amongst these we noticed most constantly a streptococcus, a diplococcus, and a bacillus similar to *Bacillus acidi lactici* of Hueppe.

The Importance of the Contaminating Organisms.

There are no experimental data to prove that any of the contaminating organisms referred to above are of pathogenic importance, and it is probable that in some cases some of the lactose fermenters found may have been purposely introduced. Apart from any remote possibility of pathogenicity, the presence of these contaminating organisms appears to us to be undesirable. Whether they ferment or fail to ferment lactose, they have undoubtedly an inhibitory effect on the growth of the partially desiccated Bulgarian bacillus. In our opinion, the portability of the tablets does not compensate for their cultural impurities. The fact that they all clotted milk in twenty-four hours is obviously no special recommendation, as virulent cultivations of *B. coli communis* would do so equally.

Methods of Administering Lactic Acid Bacilli.

In this country at the present time lactic acid bacilli are generally administered either in the form of curdled milk, or as tablets directly by the mouth.

The *British Medical Journal* of November 28th contains a well-timed warning from Dr. R. W. Allen as to the dangers of incubating possibly contaminated milk, even in the presence of living Bulgarian lactic acid bacilli. It would appear to us that this danger is much greater when the milk is incubated in the presence of non-vigorous growths of this bacillus.

We have shown that in solid preparations the bacillus is in a low state of vitality, and is frequently overgrown by contaminating organisms. The direct method of administering tablets is, therefore, useless.

The objections to incubated milk apply equally to Cohendy's sweetened whey. Herschell's malt extract solution seems unobjectionable, and is easily prepared. As milk diet is often indicated in cases in which the administration of lactic acid bacilli is advisable, we suggest the following solution of this difficulty :— Incubate the liquid preparation of living bacilli and then add it to boiled, but non-incubated milk or other sterile suitable vehicle which has been cooled to a temperature of 37° C. If an incubator be not available the liquid culture may be incubated unopened in a Thermos flask filled with water heated to 37° C. Malt extract solution or sweetened whey may be used instead of the milk if so desired. It is quite unnecessary to allow the latter to become clotted before administration.

Summary.

(1) The majority of both liquid and solid preparations contain true lactic acid bacilli, but these are only found in a state of pure culture in the liquid preparations.

(2) The liquid preparations, if retailed in smaller bulk and in hermetically-sealed glass capsules, would constitute the safest and most convenient method of administering pure lactic acid bacilli.

An ideal preparation has yet to be placed on the market.

(3) It is unnecessary to incubate the vehicle used for the administration of the lactic acid bacillus. It is sufficient to incubate the preparation itself, provided it be in the form of a fresh liquid culture, and to add this incubated preparation to the vehicle selected. By so doing, the danger of increasing the contamination of impure milk by incubation is practically avoided. In all cases,

however, milk, if selected as a vehicle, should previously be boiled.

We are indebted to Dr. Cohendy, Dr. R. Weiss, and others, for suggestions which have helped us in working out some of these problems, and also to the manufacturers of different proprietary preparations referred to in this paper, for their courtesy in placing at our disposal samples of their products.

In a later paper we hope to deal with some of the effects of the products of Bulgarian bacilli on the growth of pathogenic and putrefactive organisms.

Appendices.

I.—Method of Preparing Cohendy's Special Media.[1]

(*a*) *Gelatine Litmus Whey* (modified from Cohendy's formula).—Prepare whey from 1 litre of milk by boiling it for five minutes in the presence of 1·5 cc. of hydrochloric acid, or glacial acetic acid. Strain off the casein, and neutralise to litmus. Add gelatine, 3 grammes; grape-sugar, 15 grammes; peptone, 1·5 grammes. Make it up to 1,000 cc. with distilled water. Sterilise for one hour in steamer, filter, transfer it to tubes, and re-sterilise by the intermittent method for five days. When required for use, add 1·5 cc. of sterile litmus solution to each 10 cc. of the medium. This medium will remain semi-fluid at the room temperature, and may be used for cultures in the cool or hot incubator. When flavoured with vanilla, it is used as a vehicle for administering the lactic acid bacilli.

(*b*) *Agar Litmus Whey* is prepared in the same manner, but 15 grammes of agar are substituted for the gelatine.

II.—Herschell's Malt Extract Solution.[2]

Take a tablespoonful of malt extract and add it to a pint of water, boil for a few minutes, allow it to stand, and pour off from it any sediment which may form. The medium is then cooled to 40° C., and is ready for the reception of the bacillary preparation.

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[1] M. Cohendy, *Comptes rendus de la Société de Biologie*, 1906, vol. i.

[2] G. Herschell, "The Use of Selected Lactic Acid Bacilli," &c., *Lancet*, August 8th, 1908, p. 317.

THE EXTRACTION OF TEETH.

By Captain S. C. BOWLE.

Royal Army Medical Corps.

The questions involved as a result of the early loss of the teeth cannot fail to be of universal interest as long as no conclusive solutions can be supplied to them. Although opinions still seem to vary as to what extent the health of the human organism really suffers as a result of defective mastication, yet it will be at anyrate universally admitted that it would be a very desirable thing if the enormous incidence of decay of the teeth could in any way be ameliorated. For, as especially bearing on Service conditions of the present day, it must be maintained that a soldier who is allowed to proceed on active service with unsound teeth and a septic mouth cannot be looked upon as representing his full physical efficiency. It is true that it can be shown that a man is able to nourish himself in a correctly physiological manner on foods that require no mastication; but this argument should obviously not be put forward in the case of men who are required to undergo the privations and strenuous conditions of active service. It is also true that no disease has ever been directly traced to a septic mouth; but there is no doubt it can reasonably be held that a septic mouth may be of the greatest importance, inasmuch as it may be the means of oversetting that biological equilibrium which marks a condition of good health from a condition predisposing to disease. Again, the possession of bad teeth, like other physical deformities, tends to produce a bad moral effect. Especially ought this to be considered the case among soldiers. That form of aggressive courage expected of an able-bodied soldier is largely the outcome of his sense of physical perfection; and it would be of great benefit to the Army if the retention of soldiers who find it incumbent upon themselves to soak their bread before they eat it could be avoided. Further, there is no doubt that in many cases faulty masticating power has a direct influence on the craving for drink. Alcohol may be looked upon as a poisonous food which requires no digestion; and it is obvious that a man with bad teeth can fortify himself with a meal of alcohol under more pleasant conditions than he can "mumble" at a piece of beef which gets in his teeth and hurts his gums. No comprehensive attempt to check the excessive use of alcohol by the individual can ever be considered to have been made as long as so little attention is paid to the teeth.

With regard to future times, the consideration of these questions will be found deserving of the most earnest attention. For, as a result of the progress of civilisation, especially with regard to the increasing decline in the birth-rate, governing authorities will be bound to regard the physical efficiency of individuals as of more importance for the preservation of our national greatness than that blind trust in Providence and the sufficiency of numbers which has hitherto sufficed to support us. It is in physical incompetence, the outcome of excessive indulgence in bodily comfort rendered possible by the advance of civilisation, and not in mental incapacity, that we must look for the cause that would be likely to lose us our empire and encompass our ruin; and it may be asserted, both from a moral and physical point of view, that the most dangerous and sinister result of the advance of civilisation is manifested in the early loss and decay of teeth.

Although the empirical treatment of disease is of value to the physician, and often of value to the sufferer, yet it cannot be considered of any great value to the welfare of the species; and it is not from such treatment that any advance will be made in the physical efficiency of the Army. It is only by knowledge of the causes of disease that any true progress can be made, or any valuable efforts in that greatest of all objects, the prevention of disease, attempted. It is therefore to the causes of dental caries that our attention must be directed if any useful conclusions are to be arrived at.

Unfortunately, whatever may be considered the primary cause of other diseases, no cause which can properly be supposed to be the primary or ultimate cause of dental caries has yet been discovered. The nearest inference that can be deduced from the consideration of the earliest incidence of dental caries suggests nothing more than that a defective development of teeth was involved which produced a receptivity, or lack of resistance, to those factors which resulted in a manifestation of the disease. That it is impossible to arrive at the primary cause of caries more nearly than this is greatly to be regretted, for without such knowledge it is impossible to suggest in what way the disease can entirely be stamped out. This is more to be regretted since it seems probable that if the influence of the primary cause of caries on the present incidence of the disease could be accurately defined, it would be found from a practical point of view to be a very slight one; that is, it would probably be found of very little practical moment if dissociated from the influence of the secondary or later causes which

are dependent on it. This idea can be supported by the proposition that the unknown primary cause of caries was almost entirely accountable for that degree of decay which has been found in the teeth of primitive people. The theory involved is founded on the assumption that primitive people lived a very uncivilised life under natural conditions; that their teeth were thoroughly made use of, and that therefore none of the secondary causes of caries can be supposed to have had much effect on them. If this theory can be admitted, it may be deduced that the enormous increase of caries which has occurred since those times is almost entirely due to the increase of the influence of secondary causes. Further, if some of the more important of these could be pointed out, and it should be found possible to remove or ameliorate them, then there can be little doubt that the teeth, to a greater or lesser degree, would tend to resume their primary primitive excellent condition.

But, as we do not know the primary cause of caries, it is very difficult to decide what value should be respectively attributed to the various secondary causes, and to know which of them are important, and which are less important. It will therefore be the object of this paper to suggest that certain very important secondary causes can be sufficiently well defined, and that much can be done which is not now done to ameliorate them. It is hoped to show how a condition of affairs may be brought about which has never yet been attained, and which will result in a decrease in the prevalence of this most inconvenient and harmful disease.

In order to determine the important secondary causes of dental caries which may be subject to amelioration, it will be desirable first of all to enquire if we have any ancient data to go upon which will help us to discover them. Unfortunately, no recorded information has come down to us. In fact, no information of any description is available which deals, except in the most imperfect manner, either with the diseases of former teeth, or with the remedies which were employed to combat them. With regard to early times, we only know that dental caries was much less prevalent then than it is now, and that it has more rapidly increased during the last fifty years than at any other time. These conclusions have not been arrived at by means of any written records, but merely as a result of present-day examinations of ancient skulls, and from observations made by dental practitioners of passed days. No ancient theories of etiology can be discovered which will help our purpose in the slightest degree.

Turning to present times, it will be found that many theories

have been suggested to convey modern ideas of secondary causes of caries. Most of these will not be found to help our purpose to any appreciable extent, for the remedial measures suggested by some have been tried and failed, and those suggested by others have been found entirely unworkable. There is one theory, however, which may be used as a basis from which it is hoped to show that preventable causes may be deduced. This theory may be stated as follows: That impairment of function combined with defective development of teeth form most important secondary causes of the increase and universal prevalence of dental caries. Etiologically, it can be shown that the above theory is of more importance than any other, for it is the only one strongly supported by clinical observation, which, it is contended, as far as our knowledge goes, is our only reliable mediator. Clinically, it is constantly observed that teeth remain sound until, from some cause, they are thrown out of work, when they immediately decay. It is true that every tooth which is thrown out of work does not necessarily become decayed, but it is a matter of very common observation that this is very generally the case. Again, although it has hitherto been found impossible to prove in what way defective development of teeth renders them liable to decay, and though teeth of obviously imperfect structure are often seen to be healthy, yet it is constantly observed that the increase of weak-looking and badly formed teeth has corresponded with the increase of caries, and that teeth often become decayed before they are fully erupted. Moreover, both sound and diseased teeth are almost invariably found in the same mouth, which would seem to be the strongest evidence that, under similar external conditions, a sound tooth must be more perfectly developed than one which has become diseased. For, if not, the tooth which is the first to decay can only be considered to have either lost such immunity as the others still retain, or to have failed to acquire such immunity as has been acquired by the others. But present-day ideas hold that a race does not evolve immunity to a disease which causes no mortality. There are, moreover, no observations to support the idea that individuals can acquire immunity in teeth which are free from disease. Nor can it be shown in any way that on a tooth becoming diseased the others acquire immunity. Therefore it may very reasonably be maintained that there exists an important connection between defective development of teeth and their liability, or tendency, to disease; and finally, it may be maintained that although it cannot be exactly estimated as to what degree impairment of function and defective

development, either alone or in conjunction with one another, can be considered as responsible for the increase of dental caries, yet there is little doubt that these conditions should be considered as of great importance, and as being among the foremost secondary causes which aid in its production.

Assuming for the present that preventable causes of caries can be based upon the above theory, it will now be desirable to enquire to what reasons or causes impairment of function and defective development of teeth have hitherto been ascribed. It is generally thought that the adoption of increasingly luxurious forms of diets is the cause of impairment of function, and that the influence of heredity and the artificial feeding of infants are the causes of defective development. And while it will readily be admitted that these causes seem very likely to be of great importance, yet it will also be admitted that it is by no means clear in what way they act, or to what extent they are responsible. In considering what is known as to the influence of diets on impairment of function, our most reliable conclusions will be obtained from a comparison of conditions of primitive life with observations pertaining to the present day. And we shall find that there is no reason to suppose that the composition of diets of primitive people differed in any fundamental principle from our own. Fermented liquors have been in use from the earliest times; and sugar, although only introduced into England at a comparatively recent date, has been largely in use among the peoples of the East from the remotest ages without causing any noticeable detriment to the teeth. Nor is there any reason to suppose that the methods of preparing food for consumption have undergone any radical change. The art of baking bread has been traced to prehistoric times, and the mention of fine flour and of leavened bread is to be found in the earliest writings. The present-day adulteration of food has never been shown to have any appreciable effect on the condition of the teeth. There is one great difference, however, and that is to be found in the enormous extent to which primitive teeth were used in comparison with our own. The earliest people of whom we have any knowledge possessed no pottery and grew no corn. Their diet consisted chiefly of flesh and milk; and as their only knowledge of cooking consisted in the submission of flesh to the direct action of fire, there can be very little doubt that they must have used their teeth in a very thorough manner. On examining the teeth of skulls of the Bronze Age we find, that owing to the introduction of agriculture, teeth were used to an even greater extent. At this period whole grain and crushed

corn came to take a large place in a diet which originally consisted almost entirely of flesh. On turning to recent times, we find that the use of fine flour has been adopted to a comparatively enormous extent in a diet in which meat has taken a correspondingly smaller place, and from which the consumption of whole grain has entirely disappeared; and although it is known that fine flour was used to a slight extent in the remotest antiquity, yet it will be understood that it depended for its universal adoption, and common use, on the ever-increasing demand for comfort which is the most important outcome of the settled times made possible by civilisation. We may therefore conclude that the original occurrence of the impairment of function of teeth was chiefly determined when the consumption of whole grain was discarded in favour of the use of fine flour.

With regard to the supposition that the artificial feeding of infants is a cause of defective development, we must admit that we have very little evidence to support it. It may be taken for granted that practically all infants down to a very late date were fed in the natural manner, and it must be admitted that artificially fed children seem to have no worse teeth than those who are not so brought up. As to other matters of infantile hygiene, it is obvious that the domestic conditions under which gregarious human beings occupied pit-dwellings or pile-huts would be likely to be no better than those which obtain at the present day.

The influence of heredity on the defective development of teeth has never been satisfactorily shown. By the analogy between structures which have become eliminated by disuse, and the gradual elimination of the wisdom teeth, it has been suggested that by means of natural selection man is regressing to a condition of toothlessness which is supposed to have existed in an early stage of his evolution. But while there is no doubt that a considerable arrest of development must have occurred to account for a rudimentary wisdom tooth, yet it has never been observed that such arrested development is particularly liable to predispose to disease. It is generally held that only a tendency to disease can be transmitted by heredity. But it has never been satisfactorily shown in what way this tendency originates, in what it consists, or whether defective development ought to be considered the cause of it. It would seem, when we remember that in an unbroken mouth one tooth decays before the others, that the expression "the inherited tendency to disease" really denotes an undefined defect of development, apart from arrested development, which results

in disease. Be this as it may, there is no doubt that defects of structure are transmitted by heredity, but we have unfortunately to admit that all questions as to the origin of such defects remain entirely unexplained.

Finally then, although it will be granted that soft diets are a most important cause of impairment of function of teeth, and that much might be done which is not done now to urge a return to harder food, and although it will be granted that some undefined hereditary factors have been at work to exercise an important and apparently increasing destructive influence on the development of teeth, yet it is suggested that there exists, holding an assured position among us, a practice which, fostered by insidious and false expedients, forms a factor whose evil influence in causing impairment of function and defective development of teeth makes all other causes comparatively and practically unimportant—a practice which much can be done to eradicate, and which until greatly ameliorated gives us no hope that any progressive attempts can possibly be made to combat a disease which will eventually come to be considered the greatest physical disaster which has yet befallen us.

The extraction of teeth was originally instituted as a humane treatment for the relief of pain ; it was evolved from the natural custom of pulling out loose teeth with the fingers, and it originated in the development of that amount of skill which was necessary to fashion a tool by means of which it could be effected. In early times nothing better was recognised and nothing further attempted. Its destructive effects were not then noticed, and it was kept within reasonable bounds by the excessive pain attending the operation. Very little is known of the development of this practice through the Middle Ages. We only know that it made progress corresponding to the advance of disease, and that various barbarous instruments were used to effect it. It was not till a hundred years ago that the first great impetus was given to tooth-extraction by the invention of the modern pattern tooth forceps. It was found that by the aid of these forceps the extraction of teeth could be performed with less pain to the sufferer and with greater ease by the operator. But it was not till about sixty years ago that tooth extraction began to thrive beyond its proper sphere.

In the year 1844 nitrous oxide gas was introduced into dental practice. Then came about, to use the memorable words used on the occasion of its first administratian, "a new era in tooth-pulling." Painless extractions became a reality to the patient and

a source of great benefit to the operator. The practice of pulling out or cutting off diseased teeth, or teeth which were inconvenient to the adaptation of artificial dentures, grew and flourished exceedingly. Coincidently, the mechanical dentist began to rise to a lucrative position, and in 1858 the Royal College of Surgeons of England found it necessary to grant a dental diploma with a view to check the uneducated practice of dentistry. Up to this time the conservation of teeth by " stopping " had made very little progress. The " stoppings " attempted did not find favour with the public. There was pain dependent upon their insertion, and lack of permanence of their good results. Gas, forceps, and false teeth were considered the most desirable way of meeting the tooth question. By such means pain was avoided, the powers of mastication were not necessarily done away with, and, above all, the personal appearance could very decidedly be improved. The introduction of gas therefore, while it has been the means of relieving a great deal of pain, was undoubtedly the greatest check to the advancement of conservative dentistry and the greatest incentive to tooth-pulling that could possibly have occurred. By its means radical dentistry obtained an initial advantage in point of time over conservative dentistry, and succeeded in establishing such a firm hold on public opinion that it not only resulted in the bias of the dentists in its favour, but also procured for itself such important consideration and world-wide support that its abolition in favour of conservative dentistry will be found a matter of great difficulty, taking years to accomplish. It is very generally believed at the present day that conservative treatment of teeth is unsatisfactory; that " stoppings " usually fall out, and that false teeth are the proper and only satisfactory cure for dental caries. In a recent examination of 680 unselected cases of soldiers aged 21 and over, it was found that the sound molars in the " bite," instead of being twelve, had been reduced by disease and the forceps to an average number of 3·8, many of which were only of equal value to the unsound teeth which opposed them. Such loss of masticatory power had undoubtedly been greatly encouraged by the unfortunate reliance placed on the supposed universal efficacy of artificial appliances.

Local anæsthetics are the only important aids to tooth extraction which have been introduced during latter days. These will tend to remove the last remaining objection to the submission to forceps, namely, the unpleasantness associated with the administration of general anæsthetics; and although they have not yet

produced any marked effect on the present condition of affairs, yet there is no doubt that a further strong incentive to tooth extraction is provided by them.

As an example, a common occurrence of the disastrous manner in which extraction causes impairment of function of teeth, we will take the instance of the early loss of the lower sixth-year molar in a previously unbroken mouth. As a result, the teeth on both sides of the space caused by the extraction will be found to tilt towards one another, and the wisdom tooth when it erupts will

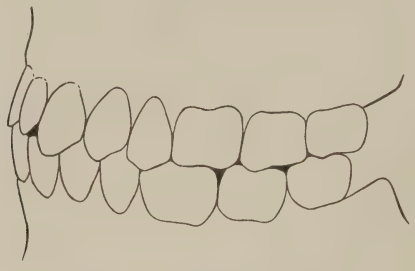

Fig. 1.—Normal Occlusion.

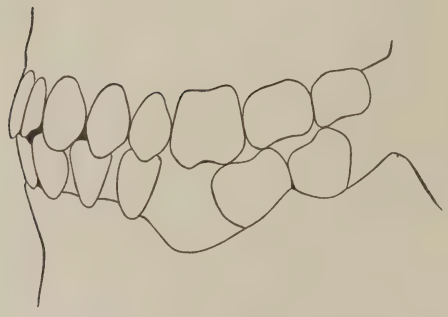

Fig. 2.—Common result of the early extraction of a molar.

be found to tilt forwards. Thus the occlusion on the mutilated side of the mouth is more or less entirely destroyed, and all the affected teeth develop a marked tendency to decay.

The damage, however, by no means ends here. The teeth on each side of the space caused by the extraction may have their roots partly exposed by recession of the gums. In masticating, the remaining teeth will impinge upon one another in an unnatural manner, which will result in excessive strain being thrown upon them, thus causing premature looseness. Should a tooth be com-

pletely thrown out of the "bite" (*vide* upper sixth-year molar in diagram), it will not only almost invariably decay, but will tend to rise in its socket and become tender and loose. A sixth-year molar is usually the first to go, and as a result other teeth are lost in quick succession, till at length impairment of function is more or less complete, and the masticating power, in many neglected cases, is irretrievably destroyed.

It will now be considered in what way extraction may be regarded as aiding defective development of teeth. If the teeth of people about to marry are examined, it will almost invariably be found that both individuals have suffered the loss of one or more grinders. Impairment of function will be present in both. The nutritive supply of the teeth which have been extracted will have been for a greater or lesser number of years completely abolished, and the nutritive supply of those which remain will be detrimentally affected by lack of use. If marriages are contracted under such conditions for a number of generations, it can be very reasonably assumed that the teeth of the offspring will be imperfectly developed. Unfortunately, there is no analogy to support this hypothesis. On the other hand, the much-quoted case of the terriers' tails does not in any way disprove it. There is no reason to suppose that the influence of heredity can be bound by any hard-and-fast rules, and it need only be said that the docking of tails, unlike the extraction of teeth, does not give rise to modifications of development which are apt to cause disease.

If, then, it is admitted that impairment of function and defective development of teeth, acting either alone or reciprocally, are powerful factors in the increase of caries, what practical need is there to look beyond tooth extraction as the cause of them? What need is there to ascribe the increase of caries to the physical degeneracy of the race, the defective feeding of infants, the adulteration of food, the absence of lime-salts in water, &c., as long as extraction holds its present position among us? Be this as it may, this much is certain, that as long as extraction is carried on to its present extent no practical good will come of efforts to combat the increase of decay; it offers an obstacle to research; it confuses our estimates of present signs; and, above all, it obstructs any attempt at an accurate prognosis as to whether the disease could be, for all practical purposes, entirely stamped out under more scientific treatment.

As no constitutional treatment has ever been found to have any beneficial effect on the incidence of caries, it follows that we

must rely entirely on conservative dentistry to prevent the loss of teeth. "Tooth-stopping" has been accomplished from the earliest times. But the art of early dentists appears to have been entirely devoted to æsthetic improvements; and it is only of late years that methods have become possible by which fillings can be made permanent, and further decay prevented. It was about fifty years ago that the results of tooth-stopping became capable of complete revolution. This was due to the inventions of the dental engine and of the rubber saliva-dam. By means of the engine all dental cavities, in any position, could be thoroughly cleaned; and by means of the rubber dam all dental cavities could be kept thoroughly dry during operation. As a result of these enormously important aids, filling operations are now capable of practically absolute and universal permanency. Fillings need no longer fall out, and no person who will submit to the thorough operations of conservative dentistry, especially if carried out at the inception of the disease, need ever lose a tooth as the result of decay. Unfortunately, however, notwithstanding the very satisfactory results which can now be obtained, conservative dentistry has hitherto failed to occupy the favourable position in public esteem which it undoubtedly deserves; and even at the present day a singular lack of information prevails as to what can be done by it. This ignorance is by no means confined to the poorer classes. It would appear that all ranks of society are affected. Most unfortunately, even medical men, for the most part, are very much in the dark on matters concerning dentistry, and thus their most important and weighty influence is often either entirely withheld, or unwittingly given in support of unsound practice and second-rate ideas. Bred out of this general ignorance, the leaning to quackery seems to be as marked to-day as it ever was, and undoubtedly appears in places where we should least expect to find it. Unqualified dental practice, quack nostrums and remedies, are universally common, and no improvement seems likely to take place as a result of recent attempts at legislation. In olden days many practitioners relied on the ignorance of the public to conceal their own ignorance, and quackery and secrecy were fostered among them as a rule of their apprenticeship and other educational systems. But nowadays we have to deal with a very different, but no less unsatisfactory, state of affairs. The advance of knowledge in both the medical and dental professions has been so rapid that it has completely outdistanced public appreciation, and a practitioner who would earn his living is placed in the extremely unpleasant position of having

to work down to the level of public prejudice. It is obvious, therefore, as long as popular ignorance prevails, that quackery will continue to flourish and sound methods will remain almost impracticable; and although it is undoubtedly good to withhold all kinds of medical knowledge if no great interests are at stake, yet to connive at ignorance in matters which detrimentally affect the national physical efficiency is wrong and should not be tolerated.

In trying to institute universal conservative dentistry, it is often held that the only satisfactory scheme lies in the education of children. But while such education will be of undoubted benefit, yet children are not good subjects for the practice of conservative dentistry, nor are they ever likely to become such. Temporary operations, as a rule, are all that can be done for them. The amount of pain which is unavoidable as a result of thorough conservative work will never be willingly tolerated by people who are not old enough to consider their future welfare. It is only by the instruction of all classes of people that progress will be made; and although children should undoubtedly be obtained when possible, yet practically, young adults form the best class for the actual practice of conservative dentistry. The systems of secondary education should no longer continue to avoid matters which affect the national health. If it be asserted that no time can be found to instruct students in the main facts concerning their physical well-being, it is quite certain that too much time is taken up in acquiring knowledge of far less importance. That the poorer classes are very quick to assimilate sound principles is well shown by the crowds of people who every morning attend the dental hospitals for treatment. These classes take the most intelligent interest in all that is done for them, and it is very difficult to imagine how it is that they have hitherto remained so completely uninstructed.

The whole responsibility for the spread of a knowledge of the value of conservative dentistry rests with the dental profession; and there is no doubt that the greatest credit ought to be given to them for the efforts they have made, and are still making, in instructing the public. The British Dental Association and its various Branches are constantly memorialising governing bodies and educational authorities to institute systems of dental inspection, treatment, and instruction for schools. In the dental hospitals the best surgical principles are taught, the most excellent work is done, and the highest attitude of a liberal profession is upheld. At the best, however, the dental profession has not a very great influence on the mass of the people. The number of its members is too

small. But the demand will create the supply, and in every way the greatest and most fundamentally important remedial measure will be established when the medical profession no longer remains apathetic to the sound principles underlying the practice of conservative dentistry. The day has unfortunately not yet come when there will be no hard-and-fast distinction, as at present exists, between the medical and dental professions. Till that time arrives it is all the more necessary that medical men should know how to properly and authoritatively advise that enormous section of the public which is unaffected by properly qualified dentists, on a subject in which the weight of their opinion would have such far-reaching and powerful influence.

In conclusion, I wish to state that by being untrammelled by private practice, and more or less unaffected by popular prejudice, no section of medical men could further this cause with more success than Army surgeons. By doing so Army surgeons would become the pioneers among medical men of a movement of the greatest national importance; and by so doing they would cause the greatest check to the incidence of a disease which may be looked on as being largely caused, and undoubtedly as being very largely increased, by the pernicious practice of the extraction of teeth.

United Services Medical Society.

THERE was a demonstration of cases in the Library of the Royal Army Medical College, Millbank, on November 11th, 1908.

Major C. G. SPENCER showed

A CASE OF LIVER ABSCESS TREATED BY REPEATED ASPIRATION AND INJECTION OF QUININE.

For particulars see "Clinical Notes," p. 71.

Captain L. W. HARRISON, R.A.M.C., showed

A CASE OF KALA-AZAR.

The patient, a gunner of the Royal Garrison Artillery, had enjoyed excellent health for the five years previous to the commencement of his present illness. For eighteen months previous to the development of kala-azar he had been stationed at Fort St. George, Madras; from September to November, 1907, he had been employed on garrison police duty, and from December, 1907, to April, 1908, he had worked as a clerk in the Brigade Staff Office; both these employments brought him into more or less intimate contact with natives. His present illness commenced in January, 1908, with daily attacks of fever, but he continued at work till April. The splenic enlargement was noted in May, and he was invalided home in July, being sent to Woolwich, and subsequently, on July 28th, transferred to Millbank. At Woolwich, Captain Cowan, R.A.M.C., recovered the Leishman bodies in large numbers by splenic puncture.

At Millbank, Colonel Leishman also recovered these parasites by splenic puncture, and succeeded in obtaining developmental forms by cultivation in Novy's medium; a point of importance, as Nicolle had stated that the Indian variety of *Leishmania* had not so far been cultivated in Novy's medium, and had suggested this as one of the points of distinction between the Indian variety and the parasite found in the Tunis form of kala-azar, for which he had suggested the name *Leishmania infantum*. Photographs, kindly lent by Colonel Leishman, illustrating the parasites as recovered from the spleen and the developmental forms obtained by him, were shown.

His blood showed a marked leucopenia, the white blood corpuscles having been 980 per c.mm. on admission in July. They had increased by September 6th to 1,241 per c.mm., but had

subsequently decreased, having been only 700 per c.mm. on October 10th. Lately they had gradually risen, till on November 7th they were 1,280 per c.mm. The leucopenia, as happened usually in these cases, chiefly affected the polynuclear cells, which in the various differential counts had varied from 45 to 51 per cent., while the large mononuclear cells had been from 33 to 41 per cent. of the whole. The red cells, which had been 2,600,000 per c.mm. on admission, were now 4,540,000 per c.mm., while the hæmoglobin had increased from 30 to 70 per cent.

The edge of the spleen, which on July 28th had been 2 inches to the right and 3 inches below the umbilicus, was now $3\frac{1}{2}$ inches to the right and $3\frac{1}{2}$ inches below the same point. He had lately suffered from pain radiating from the left side of the epigastrium down along the parasternal line to the lower edge of the spleen. This was considered to be due to perisplenitis and possibly the outcome of severe reaction occurring in the spleen.

His temperature chart was shown and illustrated the intermittent type of the pyrexia, the daily range having been for the most part from 97° F. in the morning to 101° F. in the evening. Since November 2nd his temperature had been practically normal.

As regards special treatment, he had been given 3 grains of soamin by intramuscular injections on alternate days till September 16th, when it was discontinued as it appeared to have produced no benefit. From October 7th to 16th he had been given five X-ray exposures of three minutes each to the spleen, in the hope of thus destroying the parasite, but the only effect apparently had been to increase the leucopenia, the leucocytes having decreased to 700 per c.mm. He had subsequently been given hetol by intravenous injection, commencing with 0·1 cc. of a 1 per cent. solution, and increasing by 0·1 cc. of the same strength at each succeeding injection which had been given on alternate days. Possibly the severe reaction which was at present occurring was due to these injections and they had been temporarily stopped to allow it to abate, but it was intended to resume the injections later. The patient on the whole appeared to have improved somewhat, especially as regards his blood condition and latterly as regards his temperature.

Captain KENNEDY showed two cases.

(1) A CASE OF FUNCTIONAL (?) PARAPLEGIA.

A Lance-Corporal of the Scots Guards, aged 28, was admitted to Millbank on June 17th, 1908, complaining of general weakness, vertigo, headache, and attacks of vomiting. The symptoms were

first recognised at the age of 17, and came on periodically, but latterly had increased in severity. His vomiting attacks were associated with severe epigastric pain and were at first thought to be gastric crises of locomotor ataxia. There was no history of syphilis.

Two months after admission his condition was rather worse, and the signs and symptoms were as follows: Confined to bed and unable to stand; mentally quite clear, no loss of memory; rather self-engrossed and demanding a great deal of attention; knee-jerks present, but diminished on the left side; plantar and flexor reflexes present; pupil reflex to light and accommodation, both present but rather sluggish; no squint, nystagmus, double vision, nor alteration in field of vision, and nothing abnormal seen on ophthalmoscopic examination. There was no paralysis of any muscle, but great muscular weakness, which was more marked on the right than on left side, though he was right-handed, was present; the right side of his face appeared somewhat flattened; muscular sense was quite good, so was co-ordination; there was no tremor, nor volitional tremor. Sensation of light touch (epicritical), of pain and of temperature was almost entirely gone, with the exception of the head and face, half the neck, both arms, various areas in the trunk, corresponding to the distribution of the lower dorsal nerves, and the popliteal spaces. There was an area of marked hyperæsthesia in the right lumbar region and also, but to a less degree, in the upper and inner aspects of each thigh.

He said that he was unable to take solid food, but even on a strict milk diet he suffered from recurrent vomiting, which usually came on every evening and was heralded by a severe pain in the hyperæsthetic area in the right lumbar region. It was also accompanied by severe headache over the eyes, and giddiness.

The following treatment was adopted: Isolation, strict discipline, solid food, and moderately large doses of bromide with strychnine. The good effect of this was immediately apparent by the cessation of the attacks of vomiting. These recurred only on two occasions, and even then were directly attributable to a mental exciting cause. He had improved in every way, sensation had completely returned and he was able to stand and to walk a little with assistance, but the right side was distinctly the weaker. The diagnosis was, however, still debatable.

(2) A Case of Paralysis of the Oculo-motor Nerve.

A recruit, aged 19, was seized with severe headache in the right supra-orbital region and vomiting on the afternoon and evening of September 14th, 1908.

The following morning paralysis of the third and seventh nerves was noted. On the 17th the condition was as follows: Slight herpes of the right supra-orbital region, well-marked herpes at the angle of the ala nasi and of the mouth on the left side. A mere suspicion of flattening of the right side of the face. Complete paralysis of all the muscles, both extrinsic and intrinsic, supplied by the third nerve. Knee-jerks absent on both sides until brought out by reinforcement, when the left was more marked. Plantar and flexor reflexes present. The temperature ranged from 99° to 100° F. for a week, when it became normal.

There was no history of a previous attack and syphilis could be excluded. There was a history of a very slight sore throat a week previous, but no Klebs-Loeffler bacilli were present in the throat when examined.

In the past two months there had been a very slight improvement in all symptoms. The diagnosis rested between intermitting paralysis of the third nerve (ophthalmoplegic migraine of Charcot) and a neuritis of rheumatic or influenzal origin, but the possibility of a nuclear paralysis could not be overlooked.

Fleet-Surgeon Bassett Smith showed specimens of:—

(1) Diaphragmatic Hernia.

A private, R.M.L.I., aged 20, returned to his ship from four days leave, had a big meal, and then went for a swim. In diving into the water from a height of about 2 feet he slipped, and soon after returning on board was seized with violent cramp. Hot fomentations, &c., were administered and he seemed greatly relieved, but the following evening he expired. At the autopsy was found a large rent in the diaphragm through which the spleen and portions of the stomach and transverse colon had forced themselves, as well as a rupture of the stomach itself.

(2) Aneurysm of the Heart.

This was a case of death in a public thoroughfare. The specimen showed a sacculated aneurysm, just below the auricular appendix, at the base of the left ventricle, with a slit-like perforation $\frac{1}{8}$ inch in length. There was an old patch of ulcerative endocarditis below the cusp of the aorta. The ventricular walls were thickened, with evidences of old gummata. The arteries were atheromatous. (*Vide Lancet*, October 10th, 1908, p. 1060.)

Clinical and other Notes.

SYNOPSIS OF TREATMENT OF SYPHILIS AS CARRIED OUT AT ROCHESTER ROW, MILITARY HOSPITAL.

By Captain G. S. C. HAYES.
Royal Army Medical Corps.

A man reporting sick at this hospital with a venereal sore is at once admitted into hospital. If on admission he has any secondary symptoms he is placed on the syphilis register and specific treatment commenced. This also is the case when a man has a well-indurated chancre, as experience teaches us that it is not wise in these cases to wait for secondary symptoms. If the chancre is obviously a soft one merely local treatment with some mild antiseptic is applied. A man admitted into hospital at Rochester Row is not discharged till the original sore is healed and any secondary symptoms he may have are cleared up. While in hospital the greatest attention is paid to each man's personal hygiene. He is allowed a generous diet, with milk in abundance. Spirits are tabooed, and malt liquor in the form of stout is only given in special cases of debility. Smoking is not allowed in hospital.

Treatment by Drugs.—(1) Intramuscular injections; (2) treatment by mouth or stomachic method; (3) inunctions; (4) other methods—(*a*) calomel fumigations, rarely used in this hospital, are occasionally of service in chronic skin eruptions; (*b*) intravenous injections, now never used in this hospital.

The method of treatment by intramuscular injections naturally comes first, as it is, *par excellence*, the treatment best adapted to the needs of the Service. There are many injection preparations in use at Rochester Row, chief among them being:—

(1) The insoluble salts of mercury—(*a*) calomel; (*b*) metallic mercury.

(2) The organic compounds of arsenic—(*a*) atoxyl; (*b*) soamin. Atoxyl was once largely used in this hospital, but is now superseded by soamin, which has less toxicity than atoxyl: in fact, it may be said that soamin has no toxic effects; it has been extensively used by Colonel Lambkin and Major Ward, and neither has had any harmful results from the preparation. (*c*) Arsacetin, another organic compound of arsenic. The treatment by this drug is still *sub judice*, but Colonel Lambkin has used it in several cases and had excellent results.

(3) Iodipin, a combination of iodine and sesame oil. It is given by subcutaneous injections, 15 to 20 cc. for ten consecutive days, to be repeated if necessary. When iodides by the mouth cannot be tolerated this form of injection is occasionally given.

(4) Antimony. It has been tried by Major Ward, but he considers

that the results do not justify its further use. In every case the injections cause great pain, local stasis, and have apparently no effect on the disease.

The mercurial injections in use at Rochester Row are those best known as Lambkin's creams: —

℞ Hydrarg. .. .. 10 grammes.
Creo. camph. .. .. 20 cc.
Palmitin basis. .. .. .. ad 100 cc.
10 minims contain 1 grain hydrarg. Melting point, 37° C.

℞ Calomel .. .. 5 grammes.
Creo. camph. .. .. 20 cc.
Palmitin basis. .. .. 100 cc.
Melting point, 37° C.

Dose: 10 to 15 minims once weekly for not more than four consecutive weeks. Creo. camph. is a combination of equal parts of absolute creosote and camphoric acid.

The following is given as a general guidance for these injections: Six weekly injections: four of calomel, ¾ grain in each injection, and two of metallic mercury, 1 grain in each injection. Two months rest and to attend fortnightly for inspection. Four fortnightly injections; amount of metallic mercury, 4 grains. Four months rest and to attend as before. Four fortnightly injections; amount of metallic mercury, 4 grains. Four months rest and to attend as before. Four fortnightly injections; amount of metallic mercury, 4 grains. Six months rest and to attend as before. Four fortnightly injections, amount of metallic mercury, 4 grains. Total length of treatment, two years.

Although these instructions are given merely as a general guidance, for every case must be treated on its merits, the system works out exceedingly well. In a great number of cases active symptoms have disappeared by the third calomel injection, when metallic mercury is substituted.

The following instructions are issued to all concerned in the treatment of the case and to the patient himself: (1) Weight to be taken weekly, and to be recorded on the case sheet. (2) Urine to be tested weekly and record taken. (3) Teeth to be brushed after each meal, tooth powder being supplied free to each patient. (4) The mouth-wash supplied to each patient to be used frequently. Two mouth-washes are used in this hospital, one a combination of lead acetate and alum sulphate, and the other a simple potassium chlorate solution. (5) Each patient is to spend as much time in the open air as exigencies of ward routine permit. (6) Each patient is to take a hot-air bath at least every second day, in which he will remain not longer than five minutes; the baths are only to be taken under the personal supervision of the wardmaster or his representative.

Injections of Soamin.—Sodium para-amino phenylarsenate contains 22·8 per cent. of arsenium; solubility in water, 1 in 3. When a man is placed on this form of injection the usual routine is to give a course of

ten injections, one injection on alternate days, till the course of ten is complete; each injection of 30 minims contains 10 grains of soamin. The complete course is 100 grains. In every case examined at this hospital, after a full course of 100 grains no symptoms of the disease were apparent. There are no instructions laid down as to when a second course of injections is to be given, since the drug is still somewhat under experiment. Major Ward, who has investigated a great number of cases treated by soamin by the Rochester Row method, has found that the average number of months a man is clear of symptoms from the time of completion of his first course of injections to an outbreak of fresh symptoms is approximately five months.

Arsacetin.—Arsacitin sodium acetyl phenylarsenate; solubility, 10 per cent. in cold, 15 per cent. in hot water. It naturally crystallises out far more rapidly than soamin. Colonel Lambkin uses 46⅔ minims of a 15 per cent. solution of arsacetin, *i.e.*, 7 grains of arsacetin. A course of ten injections, one every other day, is given, till a full course of 70 grains is completed. The results from this drug are excellent, but it has not yet come into general use in this hospital. As regards choice of injections, some cases resistant to soamin respond to mercury, and *vice versa*, the same with arsacetin.

In this hospital each case is carefully watched, and if it does not respond to one kind of injection another is tried, with the favourable result that treatment by other methods is rarely necessary. Calomel injections are chiefly used for dispersing early symptoms, and have a marked effect in cases of persistent induration of the primary sore. Soamin gives excellent results where there is ulceration of mucous membranes, as well as in cases of condylomata. Arsacetin gives the same results as soamin, but it also clears up early skin lesions in a wonderful manner. It has one great advantage in that it need not be prepared fresh daily as is the case with soamin.

In carrying out any of the above forms of injection the greatest cleanliness is observed, and special attention is paid to the following points: Take care (1) that each buttock is used alternately; (2) that the site for injection, which for obvious reasons is always the upper third of the buttock, is thoroughly cleansed with some antiseptic; (3) that the glass syringe and platinoiridium needle are sterilised; to ensure asepsis the needle is placed in a boiling hot bath for three minutes before each injection; (4) that the point of the needle is sharp and not turned: if this be the case the needle is rubbed with emery paper and polished on a rubber stone kept for the purpose; (5) that no hanging drop is at the needle point when it is about to be plunged into the buttock, and that the needle is driven well home into the muscle; (6) that after the injection is given the needle is withdrawn rapidly; (7) that the gluteal muscles are relaxed before plunging in the needle.

In using soamin the following additional precautions are necessary:

(1) The needle should be carefully dried after each injection before placing in the oil bath for sterilisation; if this precaution is omitted disastrous results to the operator are apt to occur. (2) After each injection the syringe and needle should be flushed out with sterilised water, otherwise the piston is apt to stick, and the needle becomes obstructed as the soamin crystallises out. (3) As soamin rapidly crystallises if allowed to cool, the solution should be placed in a small bowl, which is placed in a larger bowl filled with water at nearly boiling point: this water needs frequent changing. The last two precautions are very necessary when using arsacetin, owing to its greater tendency to crystallise. During the last twelve months at Rochester Row, where mercurial and soamin injections have been almost in daily use, not one single case of abscess or stasis has occurred. Pain after injections is extremely rare, and has never occurred after the use of soamin, arsacetin, or metallic mercury.

Treatment by Mouth or Stomachic Method.—Specific treatment by this method is obviously unsuited to Service needs, and mercury, I may say, is never given by the mouth at this hospital. Potassium iodide is given by this method, either alone, when it is usually given for nocturnal headaches with good results, or in conjunction with intramuscular injections, when it is occasionally given in obstinate gummatous cases. These latter cases, however, are rare at Rochester Row, and usually respond to one or other form of injection. If potassium iodide be used it should be given in intermittent courses of increasing doses; it should never be given continuously. Given intermittently, its full therapeutic value is obtained. If given continuously it acts as a depressant and lowers the body vitality to such an extent as to render it very liable to fresh outbreaks of the disease. The method in this hospital is to give potassium iodide in gradually increasing doses for fourteen days and then allow one week's rest. The drug is started in 10-grain doses three times a day, increasing it up to 30 grains three times a day. As a rule this dosage will be found sufficient for even the most obstinate cases.

Inunctions.—The following prescription is in use at this hospital:—

℞	Ung. hydrarg.	25 grains.
	Lanoline	12½ ,,
	Adeps benzoatus.	12½ ,,

For its use the following instructions are issued: (1) Body-weight to be taken weekly and recorded on the case sheet. (2) Urine to be tested weekly and recorded. (3) Teeth to be brushed after each meal, tooth powder being supplied free to each patient. (4) The mouth-wash supplied to each patient to be used frequently. (5) Patients to spend as much time in the open air as the exigencies of the ward routine permit. (6) Patients to take a hot bath daily, but must not scrub that part of the body into which the inunction for that day is to be rubbed. The bath

is to be taken in the morning just before the inunction. The rubbing will be carried out by a trained orderly. The part of the body where the ointment has been applied is not to be washed until the time comes to rub that particular part again. The rubbing operation is to occupy fully twenty minutes, and the body is to be rubbed in the following order: First day, arms; second day, chest; third day, back; fourth day, thighs; fifth day, legs. Then commence again as on the first day. The regions of the body rubbed are changed daily to avoid the effects of friction. The rubbing must be done slowly and pressure used. The part of the body after the inunction should look as if it had been black-leaded. As it is impossible to gauge the amount of mercury actually absorbed, the most careful watch must be kept on the condition of the patient's mouth, body-weight and urine.

This method of treating syphilis is rarely used at Rochester Row; at one time it was used extensively for cases of obstinate induration at the site of the sore, but calomel injections have superseded this method of treatment.

THREE CASES OF LIVER ABSCESS TREATED BY ASPIRATION AND INJECTION OF QUININE.

By Major C. G. SPENCER.
Royal Army Medical Corps.

The following cases were treated at the Queen Alexandra Military Hospital, Millbank, during the past eighteen months:—

Case 1.—An officer, aged 31, admitted on April 4th, 1907. While serving in India in October, 1906, he began to feel "out of sorts," with vague symptoms—malaise, drowsiness, and headache, but no fever. In January, 1907, after his return to England, he became worse, and on January 6th a sharp attack of dysentery developed. He was in bed for five weeks, and suffered very severe pain between the shoulders, but states that he had no fever then. On February 20th he expectorated a cupful of "anchovy-sauce-like material," and the pain then completely disappeared and he was very much better. He continued to improve until the end of March, when the pain returned in the left side, and he had fever every evening until he was admitted to Millbank.

On admission he was emaciated; there was some tenderness in the epigastrium over the left lobe of the liver, but no enlargement of the liver could be detected. There was no mucus or blood in the stools, and no amœbæ were found. The temperature was 99° to 100° F. every evening. The leucocytes numbered 15,000. The temperature continued to rise at night, and the leucocytosis became more marked. On April 27th, X-ray examination showed an upward enlargement of the liver, and on April 29th a deeply seated abscess near the middle line and in the upper part

of the liver was aspirated under chloroform, about 6 ounces of pus being removed. After aspiration, 4 ounces of a sterile 1 per cent. solution of quinine hydrobromate (about 15 grains of quinine) were injected into the abscess cavity through the aspirator needle. After the aspiration his temperature became and remained normal, his pain disappeared, and his general condition rapidly improved. At the end of a week he was out of bed, and he left the hospital at the end of a fortnight. Since then he has from time to time had some pain in the left side, and pain on deep inspiration, probably due to adhesions, but there has been no return of the symptoms of liver abscess.

Case 2.—An officer, aged 45, admitted on October 7th, 1907. He had dysentery in India in May, 1907, and had a relapse on the voyage home in September. On admission he had lost 4½ stone in weight, and was pale and very weak. There was marked enlargement of the liver, with pain and tenderness, and an evening rise of temperature. Upward enlargement of the liver was well seen on X-ray examination. On October 10th, under chloroform, 14 ounces of pus were removed from the right lobe of the liver by aspiration, and about 20 grains of quinine hydrobromate in 1 per cent. solution injected. The pus removed was sterile on culture, but contained some dead rod-shaped bacilli. After the aspiration he improved steadily, the temperature at once became normal, and he lost all pain and tenderness. The liver slowly diminished in size, his general health and strength improved, his appetite became very good, and at the end of a month he left the hospital to go to the Officers' Convalescent Home at Osborne.

Case 3.—An officer, aged 43, admitted on July 27th, 1908. In the beginning of February, 1908, in Arabia, he had an attack of dysentery lasting a week, and later a short relapse. In March he had symptoms of hepatitis, which passed off. He then returned to Europe, and on arrival at end of April he had an enlarged, tender, and painful liver, with some fever. For a time he improved, but on June 10th he became worse, and was laid up for six weeks, with irregular temperature, severe pain in the right shoulder and over the liver, and rapid, feeble pulse. There was no leucocytosis. He came to London at the end of July and was admitted to Millbank. On admission he was very pale, weak, and emaciated. The temperature was 101° F., and the pulse rapid and feeble. The liver was greatly enlarged, causing marked bulging of the lower ribs on the right side and bulging in the epigastrium, and was tender and painful. Deep dulness extended to the fourth space in the nipple line, and the lower edge of the liver could be felt 2 inches below the costal margin. The leucocytes numbered 30,000.

On July 28th, under chloroform, aspiration was performed ; pus was struck an inch from the surface and 50 ounces were removed. About 40 grains of quinine hydrobromate, in sterile 1 per cent. solution, were injected. That evening he was somewhat collapsed, and had some

symptoms of an overdose of quinine—deafness and a subnormal temperature. Next day he was feeling much better, and for several days he continued to improve, the liver was markedly diminished in size, the pain had disappeared and the temperature was normal. The leucocytes decreased to 12,700. But on August 3rd an evening rise of temperature began again, and from that date the pain returned, the liver became more enlarged, and the leucocytes increased to 14,700. On August 11th, a fortnight after the first aspiration, the liver was again aspirated under local analgesia and 53 ounces of pus removed, 20 grains of quinine being injected. This relieved all the symptoms for three days, after which the pain and evening rise of temperature returned. The liver was aspirated for the third time on August 18th, a week after the second aspiration, 48 ounces of pus were withdrawn, and 20 grains of quinine injected. After this recovery was steady and complete; he gained weight rapidly, the temperature remained normal, the pulse became stronger and less rapid, his appetite became very good, and at the end of a month from the last aspiration he left the hospital for Osborne. The leucocyte count remained high—14,700.

Since then he has continued to improve, though his convalescence was interrupted by a slight attack of pleurisy on the right side at the end of September, and he has twice had passing pain in the right side and a rise in temperature as a result of exposure to cold. He now feels perfectly well and has gained several stone in weight, but as late as the middle of October a blood count still showed over 10,000 leucocytes.

Remarks.—The method of treatment followed in the above cases was that advocated by Rogers and Wilson.[1] Owing to the high death-rate following open operation for the drainage of liver abscesses, several other methods have recently been put forward. Many years ago good results were obtained in some cases by repeated aspiration before the open operation came into general use. Aspiration and irrigation of the abscess cavity through a double cannula has been suggested and tried by Hull,[2] with satisfactory results. Lately Rogers has devised a flexible cannula for syphon drainage of the abscess,[3] and this has also been used with success. The mortality of the open operation is variously estimated by different observers: Megaw[4] gives it as 60 per cent. among natives in Calcutta. Among British troops in India in 1906 and 1907 it was 48 per cent. (317 operations, 152 deaths[5]). Sir R. H. Charles, a strong advocate of the open operation, gives the death-rate in hospital cases as 37·8 per cent.,

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[1] *British Medical Journal*, June 16th, 1906, p. 1397.

[2] Journal of the Royal Army Medical Corps, January, 1907, p. 40.

[3] *British Medical Journal*, October 24th, 1908, p. 1248.

[4] *Indian Medical Gazette*, 1905, p. 81.

[5] "Army Medical Department Reports," 1906, p. 221, and 1907, p. 114.

and in private cases 20 per cent.[1] The chief cause of this high mortality, apart from the presence of more than one abscess, or extreme debility of the patient before operation, is undoubtedly infection of the abscess cavity by pyogenic organisms through the open wound. This is extremely difficult to prevent, no matter how much care is taken; the large amount of viscid discharge necessitates frequent changes of dressings, air and pus are sucked in and out of the cavity by the respiratory movements, and it is very difficult to keep the skin round the wound aseptic, especially in a hot, moist climate. The great majority of amœbic abscesses are sterile when first opened, and every surgeon with Indian experience is familiar with the usual course of fatal cases—the patient does well for the first few days after the operation, then infection occurs, the temperature goes up again, and death from septic poisoning slowly but surely follows.

Any method of treatment that avoids an open wound into the abscess cavity is therefore worthy of trial, and time alone will decide which method is the best. The administration of ipecacuanha, as advised by Rogers,[2] may possibly prove a valuable adjuvant to purely surgical measures. In the three cases recorded above aspiration was immediately and strikingly successful in the first two, and Case 3 is of special interest on account of the large size of the abscess, the debilitated state of the patient, and the fact that after aspiration had failed twice it was completely successful on the third occasion. In all the cases the enlargement of the liver remained for some little time after aspiration, and the organ returned slowly to its normal size; in the last case the leucocytosis persisted for some time after other symptoms had disappeared, a point noted also by Rogers and Wilson. No doubt the abscess cavity cannot be entirely emptied by aspiration, and it must refill to some extent with blood and serum, so that a considerable quantity of blood, serum and pus remains and is slowly absorbed. This would account for the slow decrease in the size of the liver and for the persistence of leucocytosis.

Aspiration, with injection of quinine, has the advantage of requiring no special apparatus, and where the situation of the abscess is known it can be done under local analgesia. Methods involving the leaving of a cannula *in situ* are more troublesome in the after-treatment, especially if syphon drainage is to be kept up, and do not afford such complete safety from the possibility of infection of the abscess cavity.

The value of the method cannot be determined without much fuller experience, but it certainly promises well, and should be tried in every case. Even if unsuccessful it can do no harm, and in any case the patient will have had at least temporary relief and may be better able to stand the open operation. It is to be hoped that medical officers in India will give this method a fair trial and will report their results.

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[1] *British Medical Journal*, October 24th, 1908, p. 1242.

[2] *Ibid.*, p. 1249.

GENITAL TUBERCULOSIS IN THE MALE.

By Lieutenant W. G. AVISS.
Royal Army Medical Corps.

I have had two such cases under my observation, and they seem to me to emphasise the extreme seriousness of the condition and the need for earlier operative interference, a point on which the average text-book on surgery and many teaching surgeons do not lay much stress.

The first case occurred in a medical student, aged 22, who had no previous illnesses. The first sign was painful enlargement of the left epididymis and irritability of the bladder. On rectal examination the prostate and vesiculæ seminales were found involved, and were regarded as the primary seat of the disease. The lungs were clear. The case was at once diagnosed as tuberculosis (clinically and bacteriologically), and the patient was put on the usual "fresh air, cod liver oil, and aim at improvement of the general health" treatment. He wintered at Falmouth, lost no weight, and the local conditions remained unaltered. Ten months after the case was first diagnosed an abscess formed in the epididymis. The testicle and prostate were removed. The wound never healed. In two months both kidneys were involved; one was removed, the other was opened and drained. There was marked emaciation, with general debility. He died about eighteen months after the onset of the disease, absolutely worn out.

The second case is not dissimiliar. In July, 1907, I took charge of a patient, aged 31, who had been in hospital some six weeks. His diagnosis was "orchitis, non-venereal." An abscess in his left epididymis had been opened and was being drained. The man looked tuberculous, and had a history of hæmoptysis two years previously. His prostate was free, and I could detect no physical signs in his lungs. His testicle was removed, but a sinus remained. The tubercle bacillus was found in the testicle and in the pus. He was operated upon on three subsequent occasions for removal of tuberculous deposit in the inguinal region, and seemed all right at Christmas, 1907. His appearance was that of a pale, weakly, unhealthy man, his complexion being waxy, and his eyes bright and of a glassy appearance, so common in consumptive people. I again examined his chest, and could find no physical signs of phthisis. On February 16th, 1908, the man had a sudden hæmoptysis on the barrack square. He was removed to hospital. A cavity was present at the right apex, and his sputum contained tubercle bacilli. He gradually improved, but moist râles were present all over both lungs. On February 23rd he had another severe hæmoptysis and died. There was no *post mortem*.

NOTE ON A CASE OF TRAUMATIC MYOSITIS OSSIFICANS.

By Major P. EVANS.

Royal Army Medical Corps.

Corporal B. was admitted to hospital on May 7, 1908, complaining of pain in the right thigh on movement, and swelling of the front of the thigh. He stated that he had been troubled with it for two months past, following a kick.

On examination, a distinct bony tumour was felt over the middle third of the front of the thigh, and an X-ray photograph gave a definite shadow of the tumour (see photograph). On May 11th the patient was placed under ether, and a long incision was made down the thigh on the inner side of the middle line. After incising the deep fascia the tumour was exposed by moving to one side the rectus femoris and cutting through the vastus internus and crureus; it was attached to the periosteum and was slightly movable on the shaft of the femur. The tumour was removed, and consisted of soft bone: the removal necessitated sacrificing a considerable portion of the periosteum. The muscles were brought together in layers with catgut sutures, and a tube was inserted at the lower end. On May 12th the tube was removed, and the aperture closed with horsehair sutures, previously inserted. The patient made an uninterrupted recovery and was discharged to duty on June 11th. On September 5th, X-ray examination showed no tumour, and the patient suffered no inconvenience from the operation; he was able then to play football.

Remarks.—This is the second case of the kind which has come under my notice during the last two years. There is no account of them in the ordinary text-books. They are, I believe, absolutely innocent tumours, and when freely removed never recur. They are possibly caused by ossification in intramuscular hæmatomata. Tognetti (*La Liguria Medica*, May, 1908) has reported a case: *vide* the *Medical Review*, vol. ii., No. 7, July, 1908.

The parts removed were submitted to Dr. A. F. Furgusson, Professor of Pathology, School of Medicine, Kasr-el-Aini, who kindly furnished the following report:—

"I cannot find any satisfactory evidence of the existence of a tumour in any part of it. This statement refers only to the soft tissues surrounding and in contact with the piece of bone which you sent me. The tissue is made up of small tracts of voluntary muscle (in a degenerated condition), the individual bundles of which are separated by fibrous tissue, also somewhat degenerated. This latter tissue has the characters of granulation tissue, and is in some parts much more cellular than others. Irregular fragments of bone occur throughout it; the margins of these are indicated by the presence of large osteoclasts, which doubtless are concerned with the absorption of these particles of bone. These facts,

To illustrate "Note on a case of Traumatic Myositis Ossificans."
By Major P. Evans.

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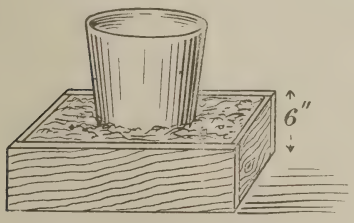
if they represent the salient features of the condition in question, lead me towards the conclusion that the trouble is essentially of inflammatory nature."

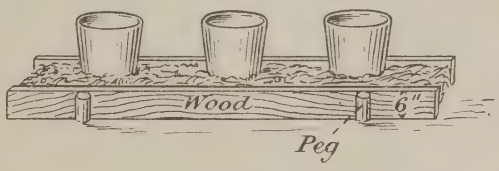
A METHOD OF PREVENTING SOIL CONTAMINATION IN FIELD URINALS.

By Captain R. McKENZIE SKINNER.
Royal Army Medical Corps.

The following plan, which, as far as I know, is original, has been found so satisfactory that I am tempted to send particulars of it to the Journal.

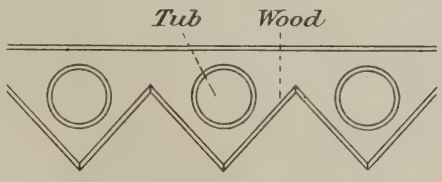
Where it is necessary to use urine tubs or buckets, whether by night in barrack verandahs, on the cement floor of permanent latrines, or on the ground in camps, to ensure a minimum of surface pollution, a box or metal tray about six inches deep and somewhat larger than the bucket should be filled with dry earth, and on this the bucket should be placed. This raises it to a more convenient height, and all splashings fall upon the earth, which can be changed from time to time as necessary.





This arrangement is quite inexpensive and most satisfactory where one or two tubs only are required, as for night use in barracks, or tent lines, or near the canteen in camps.

Where the urinal is for the use of a battalion, a mound of earth of sufficient length may be backed on both sides by a piece of match-boarding, and the surface of the earth cut off with a spade from time to time. But if possible it is then better to make the ground plan thus:—



For the greater part of this summer I have been in a camp having permanent latrines with cement floors on which the urine buckets stood, and until this scheme was adopted I found it quite impossible to keep the floors dry and sweet.

Lecture.

THE REMOVAL OF SICK AND WOUNDED FROM THE BATTLEFIELD.[1]

By Lieutenant-Colonel W. G. MACPHERSON, C.M.G.
Royal Army Medical Corps.

Introduction.

Except in the official report by Surgeon-General Sir W. Wilson on the medical arrangements in the South African War, a report that is full of valuable points, the subject of removal of sick and wounded in war is not one that has received much attention in publications connected with the British Army. A certain number of articles have appeared from time to time in military or medical journals, but they deal with it in a more or less limited manner, and not in the general or wide sense in which the staff of an army must consider it. In other countries the literature and practical exercises that concern its bearing upon staff work are very extensive, and apart from Sir W. Wilson's report it is partly to this literature, and partly to personal experience of the work, inspired by it, in Manchuria during the recent war and in military medical manœuvres abroad, that I have had to turn in order to suggest the principles which should guide one in dealing with problems connected with the removal of sick and wounded from the field.

Bearing of Field Medical Organisation on the Subject.

It is necessary to appreciate at the outset and to its fullest extent the meaning of a field medical organisation. Generally speaking, the medical service of an army in the field has four distinct functions. It is concerned with the preservation of the health of the troops; with the professional treatment and care of sick and wounded; with the replenishing of medical and surgical equipment; and with the collection and evacuation of sick and wounded from the area of active operations. All these functions are in a sense of equal importance, because no one of them can be fully carried on without the others; but it is the first and last alone, namely, the prevention of disease and the evacuation of sick and wounded, that one may regard as being of special importance to the staff officer and to the army generally as a fighting body. They are not only technical functions in a medical sense, but they are essentially technical in a military sense.

It is the last-mentioned function with which we are concerned just now. To the staff-officer it is, perhaps, the most important of all the

[1] Lecture delivered at the Staff College, Camberley, on December 14th, 1907.

functions of the medical service. As Baron von Schellendorff pointedly remarks in his "Duties of the General Staff,"[2] "the system of evacuating sick forms the basis of the entire medical service in the field." Failure to realise this fundamental principle has led to the so-called medical scandals of war, such as Dunant's description of the horrors of Solferino, the *Times* correspondent's description of the clogging of the field hospitals at Bloemfontein, and many other instances that might be quoted. On the other hand, where the principle has been recognised and thoroughly understood nothing of the kind has occurred. But apart from the avoidance of scandals, there are the purely military aspects of the subject, such as the need of keeping a field army free from an accumulation of sick and wounded in its midst. They not only hamper its mobility, but they have also a bad effect on the "*moral*" of the troops, and in the case of infectious or contagious disease are apt to endanger the healthy. Besides, it is always better for the sick and wounded themselves to be removed from the area of active operations and placed in fixed hospitals, where, until they recover, they may remain undisturbed, than to bring fixed hospitals to them in these areas. The administrative and general staff should understand the organisation by which this removal can be accomplished most effectively.

Zones of Work.

Field medical organisation, then, so far as the removal of sick and wounded is concerned, must be regarded as being parcelled out into three well-marked zones, namely:—

(1) The collecting zone.
(2) The evacuating zone.
(3) The distributing zone.

Theoretically, the collecting zone is the zone of active operations; the evacuating zone the lines of communication; and the distributing zone the base and home territory. In practice they overlap: that is to say, some of the evacuating work proper may pass into the field army zone, and part of the distributing work into the lines of communication. But it is well to keep the three zones and their normal positions in mind. It may be noted that the movement of sick and wounded is in a direction opposite to that of supplies.

Medical Units in the Different Zones.

The various *échelons* of medical service in the different zones are as follows:—

In the Collecting Zone.

The medical service with regimental units.
The field ambulances and the cavalry field ambulances.

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[2] Chapter viii., p. 540.

In the Evacuating Zone.

The clearing hospitals.
The ambulance trains.

In the Distributing Zone.

The stationary hospitals.
The general hospitals.
The hospital ships (in wars oversea).
The military hospitals in England.

The units in the first two zones are organised primarily and, one may say, solely, for the purpose of removing sick and wounded to the units in the last zone. It must not, however, be forgotten that temporary care and treatment are required during the process of evacuation, and the units are therefore organised for these purposes as well as for the purposes of evacuation.

Linking of the Different Zones and Units Together.

The zones are linked together by the Director of Medical and Sanitary Services at Army Headquarters. He has control, under the Adjutant-General, over the whole system. The units in the collecting zone are linked together under the control and supervision of the Administrative Medical Officers of Divisions, with the exception of two field ambulances and the cavalry field ambulance of the Mounted Brigade that are held with army troops under the Director of Medical Services. In the evacuating and distributing zones the units come directly under the control and supervision of the Deputy-Director of Medical Services on the headquarters of the lines of communication. The link between the collecting and evacuating zone is the clearing hospitals; between the evacuating and distributing zones the ambulance trains and the railway or waterway systems generally, or, in oversea wars, hospital ships.[1]

It is essential that these links should not be broken, especially the link between the collecting and evacuating zones. Further, it is essential that the *personnel* and material of the collecting zone should not be dislocated, in order to take sick and wounded into the evacuating zone. This was a mistake that was frequently made during the operations in South Africa, where bearer company and field hospital *personnel* were sometimes detached to take charge of convoys right down the lines of communication. The collecting zone units must always remain intact and complete, for the further a man gets from the unit the more difficult it is to get him back. One of the most prominent principles on the

[1] In Continental armies the link is formed by "Distribution Stations" or "Distribution Hospitals," and it is advisable in the British organisation to designate a group of stationary hospitals, or a general hospital at the head of the distributing zone, to receive sick and wounded after evacuation, and to classify them and sort them out, so to speak, for further distribution to the hospitals where they will remain definitely for treatment.

Japanese side in Manchuria was that of never letting a medical unit with the field army be depleted either in *personnel* or material. Another point in connection with the linking of the zones together is the necessity of maintaining uninterruptedly the movement of sick and wounded back from the field army, and it is this with which the headquarters of the army and of divisions and lines of communication must concern themselves. The outflow of sick and wounded into the hospitals in the distributing zone, for example, should always keep pace with their inflow into the medical units of the collecting zone. If there is any obstruction to that outflow, then the evacuation units, *i.e.*, the clearing hospitals, will get clogged, and next the field ambulances and fighting units themselves. If there is an obstruction in the evacuation zone, the clogging of field ambulances and fighting units will become still more accentuated.

From the commencement of a campaign, therefore, the different units of each zone should be in readiness and every part of the machinery for removal of sick and wounded in working order. Each link should be forged as rapidly as possible from front to base.

The Medical Service with Regimental Units.

Some brief account of the several medical units may help one to follow more easily the general principles on which they should be handled. Some such account is necessary just now because the field medical manual has not yet been issued, and there are practically no instructions at present regarding the new field medical units beyond the War Establishment tables. The old regulations refer to units that no longer exist.

The medical service with each battalion of infantry is one medical officer, a lance-corporal and a private of the battalion, one N.C.O. and four privates of the Royal Army Medical Corps, sixteen bandsmen (two per company) trained as stretcher-bearers, eight stretchers, and a Maltese cart with medical and surgical equipment. There are eight men trained for sanitary duties, but they are not concerned in the work of removal of sick or wounded. The Royal Army Medical Corps men are nominally in charge of the regimental water-carts, and in action may not, therefore, be available for helping the medical officer in applying first aid and collecting the wounded.

In an action the duties of the regimental medical service, as regards removal of sick and wounded, would be confined to:—

(1) Affording first aid to the wounded. Serious cases would be attended to first if possible, but no attempt should be made to do more than apply the first field dressing, to stop excessive hæmorrhage, and in some cases to apply supports to a broken limb.

(2) Directing the slightly wounded to go back on foot to some well defined spot, such as a village or prominent feature in the landscape,

which should already have been notified in orders as the collecting point for such cases.

(3) Collecting cases, not able to go back by themselves, to the nearest and most suitable cover.

(4) Throwing up some sort of shelter to protect serious cases unfit for removal from the spot where they lie.

Field Ambulances.

The habit of calling an ambulance wagon an ambulance must be avoided. An ambulance is literally a mobile medical unit, and it must be used to express the unit only. There are two kinds of ambulance:— The "cavalry field ambulance" and "the field ambulance." A cavalry division has four cavalry field ambulances, a mounted brigade has one; a division has three field ambulances, and there are two field ambulances with army troops. The composition of these ambulances need not be gone into in detail; it is given in the War Establishment tables. But the essential points to bear in mind are that:—

(1) Each ambulance has two divisions, a bearer division and a tent division.

(2) Both bearer and tent divisions are divided into identical sections; in the case of the field ambulance into three sections, lettered A, B, and C, and in the case of the cavalry field ambulances into two sections, lettered A and B.

(3) The wheeled transport material, for the removal of sick and wounded, in the field ambulance consists of ten ambulance wagons, each carrying four lying down (four to section A—the headquarter section, and three each to section B and C); while in the cavalry field ambulance it consists of four light wagons (two to each section), each for two lying down, and six heavy wagons (three to each section), each for four lying down. With each wagon there is a corporal or private R.A.M.C. as wagon orderly.

(4) The hand transport material and *personnel* are eighteen stretcher squads (six to each section) in the field ambulance, six stretcher squads (three to each section) in the cavalry field ambulance. Each stretcher squad has six stretcher bearers in the case of the former and four in the case of the latter.

(5) Both wheeled and hand transport material for carriage of sick and wounded belong properly to the bearer division of the ambulance, and not to the tent division. It is first line of transport.

(6) The bearer division is intended to perform the functions of the old bearer companies, and bring wounded back from the fighting units to a dressing station, *i.e.*, to a tent division or tent sub-division.

(7) The tent division is a modification of the old field hospital and is intended to act as a dressing station, or temporarily to receive and care for the sick and wounded until they can be evacuated. In a field ambulance it is equipped for 150, in a cavalry field ambulance for 50 patients.

(8) Each section of an ambulance can, if necessary, work independently of other sections, either with a detached group of fighting units or in different parts of the field, and each has then its bearer and tent sub-division to itself; or the whole of the bearer division of an ambulance can be thrown forward to collect and bring in wounded, and only one tent sub-division sent forward to act as a dressing station for the whole bearer division, while the remaining tent sub-divisions are held in reserve or opened as a field hospital unit under the old organisation further back. In fact, the method of using a field ambulance admits of many ways of separating, combining, holding in reserve, or opening in *échelons* both its divisions and its sections. But it is well to remember that the bearer division must depend on the tent division for providing its dressing station.

(9) In the case of the cavalry field ambulance the light ambulance wagons are intended to be sent forward as required for taking back odd casualties amongst patrol parties, while the heavy ambulance wagons remain in *échelon* with the tent division further back, in order to take wounded to the nearest clearing hospital, or to any intermediate post on the way, such as the tent division of a field ambulance; or, in order to take wounded along with the division if it is advancing to a post where they can be more easily disposed of.[1]

(10) In action, the first duty of a field ambulance is for the bearer division to establish touch with the regimental medical service of the units in the area assigned to it, and to obtain information regarding the places where wounded have been left under cover. When this is done, the ambulance wagons are brought as far forward as possible, and the stretcher squads bring the wounded to them. In doing this, advantage must be taken of natural cover. A tent sub-division is next sent forward with sufficient equipment in its forage cart to form an advanced dressing station. The ambulance wagons bring the wounded to it, although the more serious cases should be brought direct by the stretcher-bearers, when the work is not otherwise severe. The remaining tent sub-divisions remain behind waiting the development of the action. According to circumstances they may open as a link between the dressing station and the clearing hospital, or they may be sent forward to open as a complete tent division on the spot where the dressing station was established.

The Clearing Hospital.

The clearing hospital, in composition, is the same as a stationary hospital of 200 beds; but its function is a very different one. The stationary hospital is for the reception and treatment of patients during

[1] The collection and treatment of wounded cavalry soldiers present special problems and difficulties, and an article on this subject will appear in the next issue of the Journal of the Royal Army Medical Corps.

a prolonged or indefinite time. It is, in fact, a unit which, theoretically, is in the distributing zone. The clearing hospital, on the other hand, is only intended for the temporary reception and care of sick and wounded, preliminary to further evacuation. Its function is identical with that of the tent division of an ambulance on a large scale. It is, moreover, the pivot upon which the whole system of removal of sick and wounded turns, as it becomes in the field the central point to which the collecting zone converges and from which the evacuating zone and distributing zone diverge. The proper use of a clearing hospital should, therefore, be the chief consideration of the army, so far as removal of sick and wounded is concerned. It is the link between all three zones, and it is the unit which the Director of Medical Services holds for establishing the channel of flow of sick and wounded between the divisional ambulances and the railway line of evacuation.

At present it is not a mobile unit. Its material is somewhat bulky and, when packed, would require for transport by road about seventeen general service wagons. The question of making it a mobile unit is under consideration.

Clearing hospitals are mobilised in the proportion of one for each division, and their position in the field is at the head of each line of communication. They should be brought up there at once, otherwise clogging of the ambulances will occur at the very beginning of the operations, because not only may there be casualties from preliminary skirmishes, but there is from the commencement a daily inflow of sick, generally the more weakly and untrained soldiers, who break down very soon. Although many of these are trivial cases, fit to return to the ranks after a few days' rest, one must be prepared for the reception of about 2 or 3 per thousand of the troops daily, and, if the divisions are pushing forward to meet the enemy, field ambulances would soon be left behind unless the system of evacuation is established from the first. In South Africa it sometimes happened that a field hospital was so left behind and never saw the brigade to which it belonged for several months. Such incidents, of course, occurred under exceptional circumstances, but the chances of their occurring would have been minimised if the importance of a general system of evacuation covering all the field units had been fully recognised.

Whether a clearing hospital should be divisible into sections or not has not yet been determined officially, but in using it one should not hesitate to split it up into two or more sections if by so doing a long gap between the field ambulances and railhead is bridged. In such a case the clearing hospitals may form a series of intermediate posts for the temporary care of sick and wounded passing down the line. This method of using a clearing hospital or clearing hospitals will be especially needed when field operations are carried on at a distance from railhead. Further, in establishing the link between the field hospitals, the *personnel* with a

small proportion only of the material should be sent on at once, leaving the bulk of the material to follow, with some *personnel* in charge of it. This would be the correct procedure to adopt in clearing field ambulances at a time when troops are advancing rapidly against an enemy in retreat. *Personnel* and some material of a clearing hospital should then go right up to the field ambulances and take over their sick and wounded on the spot. At present the responsibility for providing it with transport rests with the line of communication command, at the head of which it is held in readiness.

These and other considerations regarding clearing hospitals will suggest themselves to an army headquarters staff under the different conditions that arise during military operations. The main point only need be mentioned, namely, the necessity of having the clearing hospitals ready at the most advanced posts on the lines of communication.

One function of a clearing hospital, which should not be forgotten, is that of expanding to an unlimited extent after a big battle. It must not limit itself merely to the 200 beds for which it is equipped.

After the battle of the Sha-ho, the Japanese made Liaoyang, which was then the railhead, their clearing hospital. It had to provide accommodation for some 10,000 cases before evacuating them down the line. In order to do so all the suitable buildings, including the private houses of the Chinese in the city, were utilised.

The meaning of expansion under such circumstances is the utilisation of local resources of every description.

Ambulance Trains.

Ambulance trains are units which, like clearing hospitals, are mobilised in the proportion of one for each division in the field; but at present they consist only of a *personnel* sufficient for taking care of 100 sick and wounded lying down. There are no specially constructed ambulance trains in this country with kitchen car, operating room, and dispensary car, &c., such as are kept for mobilisation purposes on the Continent. With us an ambulance train will have to be improvised out of passenger cars and goods vans. The method of doing this is scarcely a matter with which staff-officers will have to deal, but the collection of rolling-stock, bringing it up to railhead, arranging suitable time-tables to make it available for the daily evacuation of sick and wounded down the line, and the framing and the issuing of orders on the subject, require consideration. One knows that quantities of supplies of all kinds must be brought up to railhead, and with the rolling-stock employed for this purpose an estimate should be made in advance of the amount required on the return journey for the evacuation of the sick and wounded with the field army. Definite and systematic arrangements should thus be made, upon which the administrative medical officers of divisions and Deputy-Director of Medical Services on the line of communication can act. In Manchuria the Japanese

had a perfect system of evacuating by railway, trains being timed to start from railhead daily. Clearing hospitals were thus always able to send batches of patients away at a fixed hour. There is much more to be said on the use of railway trains for evacuation of sick and wounded, but, so far as the unit "ambulance train" is concerned, it is a unit that will have to be improvised, except as regards *personnel*, at the beginning of a campaign—at any rate under existing conditions. As military operations proceed, more permanent ambulance trains will, no doubt, be placed on the lines, as was done in South Africa; but one cannot fix too strongly in one's mind the necessity of getting trains somehow or other to run regularly with sick and wounded down the line, and for this purpose to come as near to the area of operations and fighting line as possible. Enormous numbers of wounded were got away by the Russians during the battles of Liaoyang and Mukden by means of the main line and light field railways, which formed a network right up to and behind their positions, and it is only to the organisation of evacuation by railway that their remarkable success in clearing the field of wounded was due.

If medical *personnel* of trains, not organised as ambulance trains, is required for the charge of sick and wounded during conveyance down the line, it should be obtained from the line of communication units, and not from the medical units of the field army.

Stationary and General Hospitals.

The stationary and general hospitals are the havens to which the sick and wounded are removed. They are mobilised in the proportion of two of each class of hospital to each division. The selection of their position along the lines of communication and at the base is a matter that concerns the staff of the army and of the lines of communication. The main principle is to have one or more stationary hospitals at or near railhead for cases that are likely to be fit to return to the ranks after a short period of treatment; others at the main posts along the line, and general hospitals at or near the base for the reception and treatment of the more serious and prolonged cases and those requiring invaliding. The difference between a stationary and a general hospital is mainly a difference in size, the former being organised for 200 and the latter for 520 beds; but the organisation and equipment of the general hospital are more elaborate, and approach more nearly the conditions found in the best hospitals in time of peace.

Influence of Modern Advances in Military and Surgical Science.

The problems connected with the removal of sick and wounded have been greatly affected by the character of the wounds produced by modern missiles; by the complete change in modern conceptions regarding field surgery; by the greatly extended fronts and open formations of modern

battles; and by the depth of the zone of fire. Wounds are now less liable to be fatal than formerly. The proportion of killed to wounded is, if anything, less in modern than in former times; and, on an average, may be regarded as one to four. In the battles of the seventeenth century and of Frederick the Great, the killed exceeded the wounded, or were in equal proportions, or in proportions of one to two. Modern surgical science has also had the effect of greatly reducing the mortality amongst the wounded who manage to survive the first few hours. In fact a mortality of only 5 per cent. may be expected now in injuries which formerly had a mortality even as high as 80 per cent. This, of course, tends to increase the numbers for which means of removal to the distributing zone have to be provided, because so many more survive and are fit for transport. Another effect of modern surgical science is to impress upon us how unnecessary and even how dangerous it is to handle a wound on the field or to attempt a surgical operation there. It is far better to leave a serious case alone, even for twenty-four or more hours, than to attempt to handle or remove the patient under bad conditions. The first field dressing, simply applied as a protection from dirt, is all that is needed on the field itself, with the addition of some support or other to a broken limb before removal of the patient is attempted. Hæmorrhage is nowadays either immediately fatal or else readily controlled by the firm bandage of the first field dressing. It is not the bugbear that it used to be. An appreciation of the fact that to leave the wounded alone for a time is beneficial instead of harmful greatly simplifies the arrangements for removing them from the field, because the work can then be made more systematic and orderly. The effect of open formations and depth of zone of fire is to make the work of stretcher-bearers more arduous. The distances over which they have to work are greater, and the risks of their getting hit are also greater; but the guiding principle nowadays should be to leave a wounded man where he lies, giving him as much cover as possible, until there is a pause in the fighting or until evening, when the systematic removal of all wounded left or collected under cover may take place.

The Influence of the Geneva Convention.

In countries engaging in hostilities under the Geneva Convention, the removal of sick and wounded is simplified by the articles of the Convention, because one need have no hesitation in leaving the more serious cases, and especially those unfit for transport, behind.

This fact materially alters the principles generally laid down in field manuals, namely, that the serious cases should be collected first. When it is remembered that every wounded man left to the enemy becomes a prisoner of war, and that all the Geneva Convention does for him is to ensure proper medical care and treatment till he recovers, it is evident that the chief concern of a commander in the field is to

save as many wounded from capture as possible, and, above all, to save those who are likely to be able to return to the ranks in the shortest possible time. Removal of the slighter cases from the battlefield first, next the more serious cases, and lastly the most severe of all, is the principle which should be adhered to in battles where there is any prospect of the field having to be abandoned to the enemy. Of course, if serious cases are thus abandoned a sufficient *personnel* and material must be left in charge of them. The Geneva Convention provides for the eventual restoration of such *personnel* and material to their own army; and if masses of wounded have to be abandoned, it would be the duty of the administrative staff of a division or army to determine what medical unit or section of a unit should be left behind for this purpose. Bearer divisions of an ambulance should not, as a rule, be ordered to remain, but rather tent divisions, because it is the latter that are concerned with the temporary care and treatment of the sick and wounded.

In the case of the cavalry patrols the Geneva Convention is of especial value. A man severely wounded in a skirmish, where patrols are driven back, may be abandoned to the enemy; or, where it is not possible to get ambulance wagons up in time to take the slighter cases back, and there are villages belonging to the enemy near at hand, the wounded should be directed to find their way into the villages and a note given to them calling on the inhabitants to take care of them under the Geneva Convention.

The Geneva Convention will give rise to many questions connected with road and railway transport of sick and wounded, but this is scarcely the place to enter into these questions. One point is of importance to the general staff, namely, that any escort of combatants sent with a convoy of sick and wounded for its protection against marauders, &c., may not be retained by the enemy as prisoners of war in case of capture.

The Quantity and Classification of Sick and Wounded.

This is an important factor in estimating the amount of *personnel* and transport material that is required, and in making a selection beforehand of areas of work for bearer divisions, of positions for tent divisions in the field, and of places to which clearing hospitals are to be brought up.

As regards sick, a fairly steady inflow of sick occurs at all times. By some it is estimated at 0·3 per cent. daily, but it may be, of course, higher or lower according to the presence or absence of epidemic disease. The percentage (0·3 per cent.) seems high, but it must be remembered that the majority of the cases are of a trivial character, requiring two or three days' care only. Whether it is necessary or not to remove these as far as the line of communication must depend upon the military

situation at the time. The most difficult problem will be the disposal of cases of infectious disease during an epidemic. The principle that must guide us in that case is the paramount necessity of removing and isolating these cases from the healthy troops. Where to and how far from the area of active operations must also depend on the military situation at the time. With regard to wounded the position is a more definite one. An estimate can be made with more or less accuracy of the number with which one has to deal in a pitched battle. It is not likely to be more than 20 per cent. of the troops engaged or less than 5 per cent.: that is to say, if one excludes those that are killed outright and the missing. (An instructive table to consult in this connection will be found in Note II., p. 499, of the second volume of Colonel Henderson's "Stonewall Jackson," and similar more detailed information in Bodart's "Kriegs-Lexikon," and in Brendt's "Die Zahl im Kriege.") But two main factors affecting removal must be considered in relation to this percentage: (1) Its intensity in point of time and area; and (2) its distribution into different categories of wounds.

The intensity in time and area may show that while you have only 20 per cent. of all the fighting troops wounded, as many as 50 per cent. or more may be wounded in one group or small area of the field, and a proportionately less number in another; and that, while the 20 per cent. may cover the whole period of fighting, a much higher percentage may occur in short spaces of time, as for examples, a loss of 52 per cent. that occurred in a German Fusilier Battalion at Gravelotte in twenty minutes, of 50 per cent. in a half-battalion in five minutes, and of 53 per cent. in a French battalion in fifteen minutes. At Magersfontein the Black Watch and other battalions that suffered most lost 35 per cent., although the total loss of troops engaged was only 7·4 per cent. Similarly, at Colenso some battalions lost 24, 16 and 13 per cent. as compared with only 5·8 per cent. for all troops engaged. This is an important point to remember, because it affects the distribution of field ambulances during a battle, and impresses one with the necessity of not being in too great a hurry to open all the tent divisions until it is known when and where the greatest number of casualties has taken place.

The distribution of the total percentage of wounded in different categories is of special importance in considering the amount of transport material that has to be got ready, inasmuch as one wants to have some idea of the number of wounded who can find their way back on foot, who require lying-down accommodation, who can be carried sitting up, or, finally, who ought not to be moved at all from where they lie. On the Russian side in Manchuria, one writer estimated the percentage of wounded who could go back on foot as 75 per cent. of the total, but this is manifestly too high as a general estimate, although it is possible that in wounds from the small-calibre Japanese bullet a very much larger percentage than usual went back unaided.

For working purposes I would make the following estimate for distributing the wounded into categories for transport: 20 per cent. able to walk, 60 per cent. requiring transport sitting up, 15 per cent. requiring transport lying down, 5 per cent. unfit to be moved.

Thus, out of 1,000 casualties, say, in a brigade, and representing about 25 per cent. of the fighting troops, you may expect 200 to be killed, 160 to make their own way back, 480 to require some kind of transport sitting up, 120 to require lying-down transport, 40 to be kept under the best conditions where, or near where, they fell.

But this proportion must only be regarded as the probable proportion requiring transport from the zone of operations to the head of the line of communication only. Under normal conditions, *i.e.*, unless the army is retiring before the enemy, the more trivial cases, namely, those able to walk, will probably remain at the head of the line, and the less serious cases, likely to be fit for duty after a comparatively short period of treatment, will probably be distributed to the most advanced stationary hospitals. Consequently, as one goes down the line the category of those fit to walk drops out altogether, and the proportion of those requiring lying-down accommodation may increase.

The Nature, Amount, and Use of Different Forms of Transport Material.

This is, perhaps, the point of all others to which staff-officers will have to direct their attention. Special transport for sick and wounded consists only of the field stretchers of regimental units, and the field stretchers and ambulance wagons of the field ambulances. There is nothing else specially kept for the purpose. As I have shown, even ambulance trains must be improvised, and clearing hospitals have, as yet, no transport.

A great and important duty is, therefore, thrown on the administrative medical service in the field in connection with the preparation and use of auxiliary transport for sick and wounded. As a first principle, it should be recognised that the regulation number of bearers can only work in a very limited area, and rarely, if ever, beyond the dressing stations, and that the ambulance wagons of the field medical units should not be detached from them to go any distance that would prevent their rejoining their unit on the same day. One can readily understand, then, that under conditions of severe fighting it would be impossible to prevent the field ambulances from becoming immobilised and unable to move on with their divisions, unless there is a very considerable organisation of auxiliary transport. The following methods have been adopted for providing this auxiliary transport in campaigns:—

(1) *Hand Carriage by Organised Groups of Stretcher-Bearers from the Local Civil Population.*—This is of immense value for removing the lying-down cases. It is especially easy in countries where there is a large

coolie population. It was practically the only form of transport used by the Japanese in Manchuria for the lying-down cases, gangs of Chinese coolies being organised for the purpose. It was also the method adopted during the operations in Natal in 1899-1900, where a bearer corps, 1,200 strong, of European refugees from the Transvaal, and another corps of some 800 Indian coolies, with a large number of stretchers, were formed. They were of incalculable value in transferring the patients from the field hospitals to the railway trains after Colenso, Spion Kop, and the series of actions near Pieter's Hill. (Details of the organisation of these corps will be found at p. 294 of the official report on the medical arrangements of the South African War.) In Continental armies auxiliary bearer columns with transport materials are organised and trained in peace for this kind of work all down the line of evacuation, by local branches of National Red Cross Societies. The first concern of the staff, then, should be the formation of such auxiliary bodies. They are absolutely necessary for the transport of a certain proportion of the patients over the gap between the field ambulances and the clearing hospital, and between the clearing hospitals and railhead, when there is a considerable distance of road to be covered and no suitable vehicles available.

(2) *The Use of General Service Wagons Returning Empty.*—It is on this that our present field medical organisation depends. It is definitely decided, I believe, that with the divisional transport and supply column and park no special transport shall be maintained for medical services, but that the empty general service wagons shall be used. Much consideration will therefore have to be given to the co-ordination of the work of bringing supplies up to the troops and conveying the sick and wounded back. During prolonged periods of halt, *i.e.*, during pauses in the operations, some system of distributing the empty general service wagons at definite hours of the day to the field ambulances and clearing hospitals may be arranged, but immediately after big battles (or during them, should they be prolonged over more than two or three days) the utilisation of the empty supply wagons for medical services will present many difficult problems that the staff must solve in conjunction with the transport and medical services. In the South African war the Canadian field hospital had transport that could be converted into ambulance transport, and this was considered an ideal arrangement for adding to the amount of transport available for clearing it.

(3) *The Collection, Preparation, and Use of Local Vehicles.*—It is on this that most reliance must be placed for auxiliary transport, and some idea should be formed of its amount in each locality, and how much of it can be handed over for medical services. One point, I think, is not well understood in this connection. It is generally thought that the medical pressure for transport is occasional only. If one remembers that there is a daily inflow of sick and that the balance between inflow and outflow

must be maintained, one will realise that the pressure for auxiliary transport must be constant, and that it is an error to suppose that it is only occasional. A certain quantity, therefore, of the available local material should be assigned for the regular use of the medical service between the ambulances, clearing hospitals, and railhead. But when big battles are impending the amount should be increased to its greatest possible limit and got ready. There has been no important campaign in which this form of auxiliary transport has not been used in great quantities, and in Continental armies there are definite arrangements for training men in peace in the methods of preparing the vehicles of different localities in a manner suitable for the transport of sick and wounded.

(4) *The Use of Field Railways.*—One of the most remarkable features of the war in Manchuria was the rapidity with which the Russians cleared the field of masses of wounded. Very few were left behind when they gave way before the Japanese. This was due to the use made by the Russians of the field railways. Décauville wagonettes were run as ambulance trains of twenty-five cars or less from the various positions held by the fighting troops to the main line of railway, and the wounded were thus got away with the greatest rapidity. Where there is a network of field railways, no better, easier, or more rapid method of transport, auxiliary to the transport of the medical units, can be imagined. It would be for the general and administrative staff to consider how far it can be placed at the disposal of the medical service during battle.

(5) *Use of Permanent Railways.*—The use of the permanent railways is obvious, and when a line of rail is in working order in or near the area of operations, every possible advantage should be taken of it; as much rolling stock as possible should be brought up for transport of sick and wounded in anticipation of a conflict, and a spot selected near the line, to which the slightly wounded can go direct. The use of the railway line for removing large numbers of sick and wounded during a retreat, by trains running in *échelons* at intervals of a few minutes, was practised with much success by the Russians at the battles of Liaoyang and Mukden.

(6) *The Use of Waterways.*—Waterways have been of use for auxiliary transport of sick and wounded direct from the battlefield, as, for example, during the battle of Omdurman. Where suitable boats or barges are obtainable and a good waterway exists, transport by water is a form of transport that is the most favourable of all for the serious cases, and, in anticipation of an engagement, preparations should be made for bringing boats as near the area of fighting as possible. Waterways are also of great advantage in the evacuation zone. Excellent arrangements were made for utilising them after the battle of Dettingen in 1743, and the Soudan campaigns are examples of campaigns where a waterway would obviously become the main line of evacuation.

The Use of Special Units for Removal of Sick and Wounded.

Very frequently the collection and preparation of suitable transport material, the organisation of local transport resources in *personnel*, &c., the improvisation of all kinds and means of transport, and the formation of rest or refreshment stations along the line of route are duties that will occupy the whole time and energies of a special organising and executive body of the medical service. This will be more especially the case where the clearing hospitals are some distance from railhead, and when the removal of sick and wounded by road can only be effected by stages. In many Continental armies and in Japan a special medical unit, called the "sick and wounded transport unit," is included in war establishments for this work, and is mobilised in the proportion of one such unit for each division. The question of having a similar unit in our war establishments is under consideration. At present it will be useful to remember that in the whole system of evacuation nothing in the Russo-Japanese war was more effective or more valuable than this small, independent, medical unit, and one should always contemplate the possibility of having to detail a small *personnel* for analogous duties in our own army, even though no such unit is definitely laid down in establishments. It would undertake the whole work of organising local and other resources for clearing the field ambulances and the clearing hospitals; it would establish rest stations as ordered along the line of route; it would systematically pass the sick and wounded down the line, and it would relieve the field ambulances and clearing hospitals of the anxiety and responsibility of the executive work of filling up the gaps that must exist between them and the railhead. A transport unit of this kind should be to the clearing hospital what the bearer division is to the ambulance. On account of this and other administrative reasons it is a unit well worthy of the consideration of the general and administrative staff in the field.

Calculation of Time and Material Required for Removal of Sick and Wounded.

Both before and after great battles it will be found advantageous to make certain calculations regarding the removal of sick and wounded.

Before a battle a certain number of sick may be in the ambulances, clearing hospitals and more advanced stationary hospitals, whom it is important to get away within a given time, possibly within a very short time. How is one to determine the amount of transport material required to do this, or the time required, with the amount of transport available?

Certain formulæ are of use for this purpose. Taking T to represent the time allowed, W the number of sick and wounded, t the time taken by the material used for transport purposes to make one journey and return, M the units of transport material required or available, such as an ambulance train, an ambulance wagon, a country cart, &c., and n the number of patients each unit of transport carries, we get the following formulæ:—

$M = \frac{W \times t}{T \times n}$ to obtain the amount of transport required in a given time to evacuate a given number of wounded to any point.[1]

Or—

$T = \frac{W \times t}{M \times n}$ to calculate the time taken with a given amount of transport to evacuate a given number to any point.

The latter formula will be found especially useful in connection with evacuation of large masses after a battle, the former in connection with sudden orders to evacuate within a given time before a battle.

To take a concrete example of each :—

One thousand sick and wounded, distributed as follows : 300 in the field ambulances of one division, 200 in its clearing hospital, and 500 in advanced stationary hospitals, must be evacuated to stationary and base hospitals down the line within three days. The railway line runs as far as the clearing hospital, and the distance between it and the field ambulances is 10 miles by road. One-fifth must be carried lying down, four-fifths sitting up. Ambulance wagons, general service wagons, and country carts can be made to carry four lying down or twelve sitting up,[2] and can only make one return journey each day.

Trains carrying 100 lying down or 400 sitting up are being used, and can make the return journey to the clearing hospital in one and a half days and to the advanced stationary hospitals in one day. With regard to these it is evident, without making use of the formula, that one train for 100 lying down and one train for 400 sitting up will clear the advanced stationary hospitals and be able to return to the clearing hospital by the second day, and that these two trains would be able to evacuate the patients in the clearing hospital, plus the 300 brought to it from the field ambulances, on the third day. The only calculation to be made, therefore, will be the number of vehicles required to bring sixty lying down and 240 sitting up from the field ambulances to the clearing hospital by the third day ; *i.e.*, in three journeys of the vehicles. The calculation, using the formula, would be made as follows :—

(*a*) For lying down cases—

$$M = \frac{60 \times 1}{3 \times 4} = 5 \text{ wagons.}$$

(*b*) For sitting up cases—

$$M = \frac{240 \times 1}{3 \times 12} = 6{\cdot}6 \text{ (or 7) wagons.}$$

Total wagons required = 12.

This is a simple example of one form of calculation, but it can be used, of course, to any extent and to deal with any form of transport material.

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[1] See "*Der Militärarzt*" March, 1907, article by Dr. Beyer.

[2] This is an over-estimate and is purely for illustrative purposes. A general service wagon can only carry as a *maximum* nine sitting up and three lying down.

As an example of the second formula let us take the case of 2,000 wounded in a divisional collecting zone, *i.e.*, in the field ambulances of a division, immediately after a battle; and of 10,000 in the clearing hospitals of two or more divisions waiting transfer down a railway line to the distributing zone. Three ambulance trains for 100 lying down are available with a return journey period of three days from and to the clearing hospitals. One ordinary train carrying 400 sitting up is available to run at a fixed hour daily from the clearing hospital.

In addition to the thirty ambulance wagons of the divisional field ambulances, each carrying four lying down and able to make one return journey daily from the ambulances to the clearing hospital, fifty local vehicles have been collected and they are each able to carry twelve sitting up,[1] also making one return journey each day. One-fifth of the wounded in the field ambulances are slight cases and can go on foot as far as the clearing hospitals only; one-fifth of the wounded require lying-down transport at all stages; three-fifths require sitting-up transport as far as the clearing hospitals, and four-fifths on railway trains from the clearing hospitals. How long, with the material available, will it take to clear the area of operations of its wounded?

(*a*) The number of lying-down cases to be removed from the clearing hospitals, including those brought from the ambulances, is—

$$\frac{10{,}000}{5} + \frac{2{,}000}{5} = 2{,}400.$$

The formula, therefore, gives—

$$T = \frac{2{,}400 \times 3}{3 \times 100} = 24 \text{ days.}$$

(*b*) The number of sitting-up cases to be removed from the clearing hospitals is—

$$\frac{40{,}000}{5} + \frac{8{,}000}{5} = 9{,}600.$$

$$T = \frac{9{,}600 \times 1}{1 \times 400} = 24 \text{ days.}$$

(*c*) The number to be removed to the clearing hospitals from the field ambulances, lying down, is 400, using the ambulance wagons only—

$$T = \frac{400 \times 1}{30 \times 4} = 3{\cdot}3 \text{ days.}$$

(*d*) The number to be removed from the field ambulances sitting up is 1,200, using the fifty local vehicles only. (The remaining 400 go back on foot)—

$$T = \frac{1{,}200 \times 1}{50 \times 12} = 2 \text{ days.}$$

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[1] This is an over-estimate and is purely for illustrative purposes. A general service wagon can only carry as a *maximum* nine sitting up and three lying down.

Such a calculation would show that the difficulty of clearing the field ambulances is not so great as that of clearing the clearing hospitals, and if it became necessary to clear the latter more rapidly efforts would have to be made to increase the number of trains, to reduce the distance to the distributing zone, to collect vehicles and also evacuate by parallel lines of roads, or, if circumstances permitted, to reduce the number to be cleared by bringing stationary hospitals to the localities where the clearing hospitals are. Similar calculations may be made for the use of boats and other methods of transport.

Problems Connected with the Handling and Disposal of the Medical Units.

The factor that most of all affects problems connected with the removal of sick and wounded is the handling of medical units according to the military situation at the time. Is the army halting? Is it marching without immediate prospect of engaging the enemy? Is it, on the other hand, advancing to attack? Is it itself being attacked and holding a defensive position only? All these are questions which modify the arrangements for the removal of sick and wounded. Then, again, the nature of the operations, a running action covering a considerable distance, concentrated attacks upon strong positions, night attacks, retreats, preparations for a decisive battle, measures for clearing the battlefield after an action, must modify the manner of using and disposing of the medical units.

Some general principles connected with these ever-varying conditions of the military situation may be noted:—

(1) During periods of halt only those ambulances (tent divisions) should be kept open which are necessary for the treatment until recovery of slighter cases of disease and injury: that is to say, for the treatment of men who can be returned to the ranks without removal from the zone of operations. The opening of a section of a tent division at points near groups of units, or of the whole tent division of one ambulance at some central point for the whole division, will be found sufficient under most circumstances. The object of not opening all the tent divisions is to have them ready to move in any emergency. The Japanese in Manchuria invariably adhered to this principle, and throughout the winter on the Sha-ho only one out of the four field hospitals was kept open in each division. A clearing hospital or a stationary hospital should invariably be established at railhead, for the reception of cases being brought there for transport down the railway. The same principle applies to any point where patients are embarked for transport on waterways. In fact, in a long line of evacuation by road, stationary hospitals should be the central points of the system of evacuation, and should be placed at railhead, and the clearing hospitals should then be opened as intermediate collecting points or rest stations along the road from the ambulances to railhead.

The utilisation of auxiliary transport material and the necessity of not permitting the ambulance wagons to do more than a day's return journey from their ambulances, has already been noted as a general principle in this and in all other situations.

(2) In marching without immediate prospect of attack, there is no necessity for the field ambulances marching in advance of any of the combatant troops or their supply columns; but it is always advisable to distribute the ambulance wagons, in the proportion of one to each battalion, in order to pick up men falling sick and unable to keep up with their unit. At the end of each march one of the field ambulances or a section of one should open for the temporary care of such cases, and, if necessary, evacuate them to the nearest clearing or other hospital. As the distance of the main body from the clearing hospitals increases, it would be the duty of the army headquarters staff to consider the question of advancing the clearing hospitals or sections of them, and bringing up stationary hospitals to the positions vacated by them.

(3) In advancing to attack, or in the immediate neighbourhood of the enemy, one field ambulance or one section of a field ambulance,[1] with ambulance wagons, water-cart, and forage cart as transport, should march behind the advanced guard and in front of the main body; or, if the advance is in parallel columns, there should be a field ambulance, or section of one,[2] according to the size of the column, marching immediately behind each column.

(4) When the situation is one in which a defensive position is being held, the system of disposing of the medical units will not differ much from that which should be established during periods of halt; but, in all probability, all the field ambulances, and more especially their bearer divisions, would be at work. The possibility of the defensive position having to be abandoned, and the remarks already made regarding the saving of the less severe cases from capture, must then be remembered.

(5) During the different phases of an action the main principle to act upon is to keep the field ambulances or sections of field ambulances in reserve until the action develops, and it is known where the areas of greatest casualties are. It is well to keep one ambulance or a section in reserve up to the very last, in view of a counter-attack; and, in any case, it is not till towards the end of the day that the tent divisions begin to work very actively. In the case of a possible reverse, on the other hand, it is well not to be in too great a hurry to close an ambulance until it is known that the abandonment of the ground is inevitable. There are many reasons for keeping ambulances ready in reserve. It is evident

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[1] *i.e.*, a bearer-division or bearer sub-division, according to the size of the advanced guard, with sufficient *personnel* and material from the tent division to form a dressing station.

[2] *Ibid.*

that in a running fight, for example, where the enemy's outposts are being driven in, it would be wrong policy to open the field ambulances, as they will be required to advance and open later on when the main positions are being attacked; while, on the other hand, during a concentrated attack on a strongly defended position, massing of the field ambulances in the neighbourhood of the attack would be a correct method of handling them. The field ambulances with army troops act as a general reserve should it be necessary to open in this way all the divisional ambulances.

(6) During preparations for a big battle there are many matters to be considered in connection with the removal of sick and wounded. The director of medical services, the deputy-directors on lines of communication, and the divisional administrative medical officers, must be taken into the confidence of their generals, and called upon to submit draft orders of medical arrangements for promulgation in army and divisional orders. The field ambulances, the clearing hospitals, and the more advanced stationary hospitals must be cleared of their patients as far as possible. The anticipated requirements as regards auxiliary transport must be estimated, and the material collected, parked, and prepared at some definite spot under the direction of the administrative medical officers of divisions, by whom they would be utilised as circumstances demand. The requirement of railway or waterway transport must also be estimated, and the detail carried out by the line of communication administrative officers. It is further advisable in the issue of divisional orders previous to a battle to indicate some definite and well-known spot or spots, such as a village or prominent feature in the landscape, to which the wounded who are able to go back unaided should be directed to find their way during the battle; and a field ambulance, or at any rate a tent subdivision of a field ambulance, should be sent to open at the spot immediately the troops become engaged. If there is a railway line or navigable river to which trains or boats can be brought anywhere near the anticipated area of fighting, it would be well to select a point on them as the spot to which lightly wounded should be directed to find their way. In the preparation for night attacks it is especially important to select some definite spots, such as these, beforehand, with a view to directing not only the lightly wounded, but also the stretcher-bearers, where to go. The spot should be pointed out before dark, so that the troops may have some idea of its position. In the Japanese night attacks part of the medical *personnel* of a battalion was directed to proceed to the spot indicated independently of the troops, and be there at the time the attack was made.

(7) The work of removing sick and wounded during actual fighting must be left in all circumstances to the initiative of officers commanding the field ambulances, and to the medical service with regimental units. The administrative medical officer will only be concerned in issuing orders

relative to the opening or closing of the ambulances and to the maintaining of the link between them and the line of evacuation. But a constant transmission of information regarding the situation, as affecting the number of the casualties and the area where they are occurring, should be kept up between the brigade and divisional headquarters and between divisional and army headquarters or at any rate between the ambulances and the divisional administrative medical officers, and between the latter and the director of medical services, in order to enable them to maintain the links and have the reserve field ambulances and transport material brought up to the proper place at the proper time. In most armies mounted and cyclist orderlies are attached to the ambulances and to the staff of the administrative medical officers and director of medical services for this purpose.

(8) The main work of clearing the area of operations of the wounded takes place, of course, after a battle, and the organisation of detachments for searching for and removing the wounded, whom the regimental medical service and bearer division of the ambulances were unable to bring in during the progress of the battle, will occupy the attention of the staff. Frequently, it will be found necessary to use detachments from combatant troops to aid in this work. One or more central points, usually the tent division positions, should be selected, and organised parties should work systematically over the ground. Each party should have a definite area mapped out for it beforehand, and be accompanied by a medical officer, a proportion of stretcher squads, and one or more ambulance wagons. The stretcher squads would bring any man found on the field to the ambulance wagons. These would accompany the party by the nearest roads and each, as it becomes full, would proceed to the tent division, to rejoin, if necessary, its searching party after unloading its wounded there.

Conclusion.

The principles which have been indicated above may serve as a guide in the consideration of questions connected with the removal of sick and wounded. In conclusion, the following may be taken as a general summary of the points which it is desirable to keep constantly before one:—

(1) The necessity of maintaining a constant flow of sick and wounded backwards from a collecting, through an evacuating, to a distributing zone.

(2) The necessity of keeping field ambulances intact within their own divisional sphere of work, and of opening, closing, dividing into sections, advancing or holding them in reserve, &c., according to the military situation.

(3) The necessity of organising and using all forms of auxiliary transport especially when gaps exist in the chain of collection, evacuation, and distribution.

(4) The necessity of considering the evacuation of sick and wounded according to the category to which they belong, considering that is to say, the difference in the methods of dealing with the slightly wounded as compared with the more seriously wounded, the necessity of saving the former from capture, and trusting to the Geneva Convention with regard to the latter, and the different forms of transport suitable for each.

(5) The necessity of establishing throughout all three zones, a series of rest stations or medical posts at definite intervals of space or time from one another.

This last point has only been incidentally referred to in the lecture, but it requires special emphasis. No scheme or system of removal of sick and wounded to their final destination in fixed hospital establishments is complete without these rest stations. In the case of road transport there should be one for each day's journey and in railway transport they should be placed at distances from one another of not more than six hours' journey by rail. In some places they can be combined with clearing and stationary hospitals, but these by themselves are not sufficient. The whole subject is one that requires the most careful attention if the system is to work smoothly and with success. I would regard, in fact, the organisation of auxiliary transport and of rest stations along the lines of collection, evacuation, and distribution, as two of the most important factors in ensuring the proper co-operation of the medical units with the general work of the army in the field and with one another.

Reviews.

REPORT OF THE MEDICAL OFFICER TO THE LOCAL GOVERNMENT BOARD FOR 1906-1907.

The present Report, being the *Supplement* to the Thirty-sixth Annual Report of the Local Government Board, is the first issued by Dr. Arthur Newsholme, who succeeded Sir W. H. Power as the Board's Chief Medical Officer at the beginning of 1908. Dr. Newsholme states that it is concerned entirely with the work of the Board's Medical Department during Sir William Power's tenure of office, and accordingly submits it without any lengthy comment: the actual Report, indeed, only occupies a dozen pages. Next year we hope, however, that the Report will contain a substantial contribution from the pen of the Chief Medical Officer himself. Everyone will agree with Dr. Newsholme's reference to Sir W. Power's period of office as "having been brilliant in scientific advancement and marked by great sanitary amelioration throughout the country"; and to his contributions to the Board's Annual Reports as having "become classic in the literature of preventive medicine and landmarks in its history."

We much regret the absence from this year's volume of the selections from the Reports of the Board's Medical Inspectors on the sanitary conditions of various districts and on special outbreaks of disease. These reports have hitherto been published (that is, a selection of them) *in extenso*, frequently illustrated with maps and plans, and have been of the greatest interest to all workers in sanitary science; in an especial manner has this been the case with regard to officers of the Royal Army Medical Corps charged with sanitary duties. Our officers are, generally speaking, unable to carry about with them any extensive reference library, and many of them have been accustomed to look for, and to find, in these valuable volumes full accounts of enquiries as to the prevalence of diseases, such as enteric fever, which have served as models how such researches should be undertaken and on what lines such reports should be drawn up. It is true that abstracts are given of forty-four reports of inspections and full extracts from six reports, dealing with local housing conditions; but the detailed accounts of insanitary conditions, of prevalence of disease, of circumstances affecting water supplies, and of the methods and results of enquiries undertaken in various parts of the country—which have been such a valuable feature in the preceding volumes of these Reports, and in their sum have constituted a considerable part of the classics of Public Health literature—are not this year included.

While regretting the absence of the original reports, we must not be ungrateful for what is presented in the volume before us.

The important subject of acceptance of vaccination appears in a favourable light in this Report, dealing with the year 1905. Whereas in the years 1893-97 (before the Act of 1898, which practically abolished compulsion), 67·7 per cent. of children born in England and Wales were vaccinated, and 21 per cent. were "excepted," "postponed," or "remaining"; since 1898 the "acceptance" has steadily risen from 61 per cent. to 75·8 per cent. (1905), and the "abstention" has fallen from 26·6 to 14·8: though it is to be noted that this figure is somewhat higher than the figures for 1903 and 1904 (14·7 and 14·5 per cent.). In 1893-97 nineteen counties and six metropolitan unions had 80 per cent. or more of the children that were born, vaccinated; while nine counties and six metropolitan unions had less than 60 per cent. vaccinated. In 1905 twenty-eight counties and ten metropolitan unions had 80 per cent. or more vaccinated; and only four counties and five metropolitan unions had less than 60 per cent. of the children that were born, vaccinated. So far, then, and taking the country as a whole, the fears expressed at the time that compulsory vaccination was (practically) abolished have not been justified. The three counties of Bedford, Leicester and Northampton had less than half of their births vaccinated in 1893-97; the same three counties were in the same position, at the bottom of the county list, in 1905. Of four metropolitan unions that had less than 50 per cent. vaccinated in 1893-97, Bethnal Green and Mile End occupied the same position in 1905, while Hackney and Shoreditch had slightly improved their status.

Transmission of enteric fever by carrier-cases is considered to have been the probable cause of an outbreak at the Belmont Asylum, Sutton (sixty-four cases, eleven deaths), enquired into by Dr. Copeman; and at

Brandon (Durham), where there had been considerable enteric prevalence in 1904-05-06, Dr. Fletcher considered that the men and boys became infected while working in the pits, and the women (later cases) through acting as nurses. One colliery was especially affected; and there also appeared to be a considerable spread from house to house.

It is interesting to note that an outbreak of diphtheria in the families of the officers at Dartmoor Prison was considered by Dr. Sweeting to be "referable not to insanitary conditions, but to evolution from minor sore throat antecedent in the village, largely spread at school."

Dr. Bruce Low contributes valuable summaries of the progress and diffusion of plague and cholera throughout the world during 1906, in continuation of similar reports in previous years. He notes in regard to the outbreak of plague in Seistan (Persia), that there was no evidence of spread of the disease by rats; "indeed, it is worthy of mention that neither *Mus rattus* nor *M. decumanus* is found in the province of Seistan. Though these rats are awanting, fleas are said to abound in large numbers." Captain Kelly, I.M.S., suggested that the infection might have been brought by migrating waterfowl passing from Astrachan into Persia. The plague bacillus can live in the flea for eight days. If a wild duck were to eat a recently dead rat, fleas might be transferred to the duck and carried to Seistan. It is stated that the epidemic first appeared solely among the tribesmen living in the marshes, whose main pursuits are wild-fowling and fishing, the agricultural population not being attacked until later.

A succinct *résumé* of cholera manifestations in 1906 has reference chiefly to India, where the mortality from this disease was higher in 1906 than in any year since 1900. The disease also prevailed in the Philippines (in some places due to use by Chinese of human excrement as garden manure on the banks of a river), and in some parts of Russia. Some alarm was caused in October, 1906, by the arrival at Queenstown of the "Peruviana" from Rotterdam, *viâ* Penarth, having two of her crew dead and four others seriously ill with gastro-intestinal symptoms. No evidence was found for the diagnosis of Asiatic cholera: but several of the crew had partaken freely of mussels while at Penarth; it was said that these mussels had been collected from piles covered with copper.

The remainder of the volume is occupied chiefly by accounts of laboratory investigations of considerable importance. Dr. Klein contributes a further research in connexion with Plague, dealing with the prophylactic and therapeutic use of material derived from the organs of animals dead, or recovered, from plague. "It may be that there is here basis for securing a satisfactory therapeutic agent from cases of naturally acquired plague, but obviously these are points which require to be made the subject of further experiment" (p. 140).

The report of Observations on some of the Defensive Mechanisms of the Body against Pyogenic Cocci, by Drs. F. W. Andrewes and M. H. Gordon, is of great interest. It was undertaken with special reference to methods of inhibiting the injurious activities of pathogenic micro-organisms of this class when they gain access to the body; and in the

first place the methods which are available for measuring these defensive forces came to be tested.

Three means of defence against invading bacteria are employed by the human body: (1) A chemical antidote may be produced, neutralising the bacterial poison but not attacking the bacterium itself—this is chemical, or "antitoxic" immunity; (2) substances may be formed capable of destroying the bacteria, apart from direct cellular intervention—this is "bacteriolytic" immunity; (3) the bacteria may be destroyed by special cells of the body—this is "phagocytic," or, since opsonins form an important part of the process, "opsonic" immunity. Any or all of these defensive means may be employed, but the phagocytic is generally held to be the most usual one. With regard to staphylococci and streptococci, there seems to be no evidence that they form soluble poisons, therefore antitoxic immunity is not demanded; moreover, it is generally agreed that the serum, both of man and animals, normal or immunised, is devoid of any bactericidal action upon cocci. The only existing evidence as to means of defence against pyogenic cocci refers this defence to phagocytic action. Wright and Douglas showed (1903) that the serum of animals immunised against *Staphylococcus pyogenes aureus* contains an increased amount of the substance which prepares this coccus for phagocytosis, which substance they named opsonin. Rosenow has since been able to show that there exists an inverse ratio between the virulence of a given strain of pneumococcus, and its capacity for being taken up by the phagocytes; pneumococci of high virulence, *e.g.*, could not be taken up at all; as their virulence lessened on subculture, the phagocytes became able to engulf them in presence of opsonin, and exceptionally even in its absence. The authors have in the present research endeavoured to ascertain the principal means by which the living body defends itself against invasion by pathogenic micrococci; they limited their observations to *S. pyogenes aureus*, and chose the rabbit for study of the interactions, as being neither too susceptible nor too refractory. As the result of experiments carried out by Wright's method, with the capillary pipette, they failed to obtain positive evidence of any bactericidal effect on *S. pyogenes aureus* by (1) human blood; (2) normal and immune rabbits' blood; (3) normal and immune horse serum; or (4) normal and immune horse serum in the presence of leucocytes. Considering, however, that the number of organisms present in a blood or serum is the resultant of the two opposing factors—(*a*) tendency to destruction by antibodies, and (*b*) tendency to multiplication of the organism; and that presumably a given amount of serum can only destroy a limited number of bacteria; consequently, that if the bacteria are excessively numerous, the survivors (after the bactericidal substance has been used up) will be able to multiply *ad lib.;* and therefore that the capillary pipette method would fail to detect bactericidal action that had occurred only during the earlier hours of contact, and was later compensated by multiplication of the surviving individuals—the authors devised experiments for determining the rate of bacterial mortality or bacterial multiplication.

Reference must be made to the original memoir for the details of the experimental methods, which do not admit of abbreviation. The conclusions arrived at were: (1) That in water, and in solutions of simple substances incapable of affording bacterial nutriment, the drop in the

numbers of cocci present is a rapid and fairly uniform one, with no preliminary multiplication; (2) that in artificial proteid media, in which no question as to the presence of specific antibodies can arise, there is multiplication almost from the first. Thus, in distilled water, taking the number of cocci present at the start to be 100, after one hour there were 45·8, after two hours 7·8, and after three hours 0·4.; in artificial proteid media (such as peptone 1 per cent., fleischwasser, broth), taking the number at the start as 100, after one hour there were 106·2, after two hours 149·8, after three hours 476·7. Experiments were then made with defibrinated normal rabbit blood, defibrinated blood from immunised rabbits, and serum from rabbits (normal and immune); in each case, not merely an inhibitory, but an actual bactericidal, effect was produced on the staphylococci; the blood of the immune animals had a greater bactericidal effect; if heated to 55°—66° C. this effect was diminished; therefore the bactericidal substance is largely thermo-labile, and like other antibodies, it becomes "anchored" to the cocci, because it was found that when the defibrinated blood was saturated with cocci, previously killed by heat, the bactericidal substance was removed, partially or entirely. Finally, experiments were made with defibrinated human blood and serum, heated and unheated, which confirmed the rabbit blood experiments. The numbers of cocci present at the beginning are largely reduced during the first three or four hours, after which an increase takes place. There is "not merely an inhibitory, but some degree of bactericidal action upon *S. pyogenes aureus*, on the part of defibrinated blood and serum, both from the rabbit and from man." The authors point out that "even though the destructive action is exhausted at the end of three or four hours, the reaction may be of great value in bodily defence. For the process of infection, as it naturally occurs, must usually consist in invasion of the tissues, not by battalions, but by units which later multiply into battalions. A bactericidal power, even though of relatively slight degree, may suffice to annihilate the first units; and a reduction of 50 to 95 per cent. in numbers is more than a slight means of defence. It may be a valuable adjunct, or rather preliminary, to the more active defence possessed by the body in its phagocytes" (p. 169).

The above experiments are, as the authors say, "an essential preliminary to the investigation of the sequence of events *intra vitam* when infection takes place." Observations have been commenced on rabbits, and a continuation of this important research will be awaited with interest.

Dr. Andrewes contributes another report, of great value, on the Micro-organisms present in Sewer Air and in the Air of Drains. Until quite recently it has been generally considered that the air of sewers and drains, when these are properly constructed and in good condition, is comparatively free from organisms; and that when these are present, they are derived from the outside air of the atmosphere rather than from the sewage. This opinion has been chiefly grounded on the experiments of Carnelley and Haldane in 1886, Petri in Berlin, Levy and Miquel in Paris (1891), and the full investigations of Parry Laws (1892-94), with the later stages of which Dr. Andrewes, himself, was associated. All these were fairly concordant as to the main points—that the number of micro-

organisms in sewer air was not large, and that those which were present were mostly due to ingress of atmospheric air, and were not derived from the sewage. The paucity of organisms in sewer air was explained by Hurtley (Report to the Hampstead Sanitary Authority, 1905) by the fact that sewer air is always saturated, or nearly saturated, with water vapour; if only a slight lowering of temperature occurs, condensation will take place on any floating particulate matter (*e.g.*, bacteria), which will be deposited, and the sewer air consequently cleansed; this condensation occurs regularly at night. Dr. Andrewes does not, however, refer to the view advanced by Tichborne, of Dublin, some years ago, who looked on this phenomenon in a different light. He considered that sewage organisms were carried about, as on a raft, by the droplets of condensed vapour formed during the cold hours of the night, and dissipated when the air becomes warmed; thus leaving the imponderable microbes floating about in the air, which might consequently become a medium for spreading specific disease. This opinion as to the injuriousness of sewer or drain air (which always commended itself to many workers in preventive medicine, as a rational explanation of the undoubted fact of the connexion, either *post* or *propter*, between the incidence of certain diseases and access of drain air to dwellings) received great support from Major Horrocks' observations on the presence of sewage bacteria in the air of ventilation pipes, inspection chambers, drains and sewers (Journal of the Royal Army Medical Corps, October, 1907). Dr. Andrewes also himself found evidence of the presence of *Bacillus coli* and sewage streptococci in sewer air, as detailed in his Report to the Hampstead Sanitary Authority, 1905 (quoted in *Public Health*, July, 1907): and he now reports a very full investigation, which will probably set the matter at rest, being in the nature of a *positive* finding, not (as were the earlier observations) merely a negative result. This has come about by the improvements in the methods of bacteriological research, and shows the absolute necessity for repeating observations, and revising the conclusions drawn from them, at periodic intervals.

In the present investigation, Dr. Andrewes has made special search for members of the streptococcus and *B. coli* groups. "It was required to prove that certain organisms in sewer air are of human fæcal origin, and not derived from the fresh air. But the fresh air of towns, especially in dry and windy weather, is extensively polluted by dried horse-dung. It has, therefore, to be shown that sewer air contains microbes which are not found in fresh air, and that such microbes are characteristic of sewage rather than of horse-dung." The relative frequency of the different members of the *B. coli* group in human fæces and horse-dung is not known; therefore reliance has to be placed on their relative biological characters, as found in the three situations—sewer air, fresh air and sewage. Conradi-Drigalski medium was the selective medium adopted, possessing the double advantage of inhibiting most of the common air organisms, while permitting free growth of most streptococci, and of the *B. coli* group, with appearances characteristic of the various "types," or "strains." Dr. Andrewes speaks of these in one place as "the individual species," but this term is certainly not strictly applicable to the "strains," or "races," or "groups" in question; as he himself allows. The air investigated was generally taken from a passage leading from a manhole

to the main 18-inch drain of St. Bartholomew's Hospital, just before its outfall, through an intercepter, into the sewer in Little Britain; the ventilation of the drain was good, and no unpleasant odour was noticeable.

The streptococci observed were found to range themselves under six groups, in addition to the pneumococcus:—

	S. equinus	*S. mitis*	*S. pyogenes*	*S. salivarius*	*S. anginosus*	*S. fæcalis*
Litmus milk: acid ..	−	+	+			
,, clot ..	..	−	−	+	+	+
Neutral red	..	..	..	+	+	+
Saccharose	+	+	+	+	+	+
Lactose	−	+	+	+	+	+
Raffinose	..	..	..	±	±	−
Inulin	..	..	..	..	..	−
Salicin	+	..	+	+	+	+
Mannite	..	..	+	..	..	+
Length of chain in broth ..	Short	Long	Short	Long	Short	

The streptococci of fresh air were first sought for by exposing plates of Conradi-Drigalski medium for an hour in various situations near St. Bartholomew's Hospital. The reactions of eight strains thus obtained were found to indicate *S. equinus* in four instances, and a variety of the same in another instance; one was a variety of *S. fæcalis*, another a variety of *S. salivarius*, and a third differed from all the rest. These results were similar to those obtained by Andrewes previously a Hampstead, and by Gordon in his House of Commons experiments. "It may be regarded as established that, of the streptococci to be obtained from fresh air in London, a great majority (65 per cent. of the sixty-four recorded strains) belong to the *equinus* type and are presumably derived from horse-dung." Members of the *mitis* type (3 per cent.), of the *salivarius* type (6 per cent.), and of the *fæcalis* type (20 per cent.) also occur.

In various experiments on the micro-organisms present in sewage Dr. Andrewes has found streptococci to be the most abundant, more so than *B. coli* in any of its forms, or any other organism. He has found streptococci present in the proportion of 100,000 up to 10,000,000 per cc. Nineteen strains of sewage streptococci are described, the *salivarius* type being most abundant (58 per cent.); while the *equinus* type forms only 5·2 per cent. of the total. It is to be remembered that the *salivarius* type is found not only in the saliva, but also abundantly in fæces.

Proceeding now to the streptococci in sewer and drain air, Andrewes found at St. Bartholomew's Hospital six strains, all of *salivarius* type. Previously at Hampstead he had found thirteen strains, eight of which were of *salivarius*, and five of *fæcalis* type; no streptococcus of *equinus* type was found at all. Therefore, the characters of sewer and drain air streptococci are mostly those of the sewage types and not those of the fresh air types. This is shown in the following table:—

Percentage Distribution of Streptococcal Types.

	Fresh air	Sewer air	Sewage
Equinus	65·6	0	5·3
Mitis	4·7	0	21·1
Salivarius ..	9·4	73·6	57·9
Fæcalis	20·3	26·4	15·7

"The conclusion appears irresistible that the streptococci to be found in sewer and drain air are in the main not derived from the fresh air by processes of ventilation, but are derived in some way from the sewage itself."

The biological characters of the members of the *coli* group are then considered, as they are found in the fresh air, in sewage, and in the air of drains and sewers. The media employed were Conradi-Drigalski plates, MacConkey's bile salt, neutral red lactose agar, and lactose litmus broth.

For the fresh air observations large plates (of 6 inches diameter) were exposed, generally for an hour, near St. Bartholomew's Hospital on seven occasions under all sorts of atmospheric conditions, but not during actual rain; fifteen plates in all were exposed. Once an aberrant member of the *B. coli* group, and twice *B. lactis aërogenes* were recovered, and these three colonies represent the total result, as regards the *B. coli* group, of all the fifteen exposures. This group of organisms must, therefore, be of very sparse distribution in the air of the city of London.

For identifying the *coli* group in sewage, Andrewes used the following tests: gas formation in gelatine shake, acid formation and clotting in litmus milk, reduction of neutral red, and indol formation in peptone broth; together with MacConkey's media, viz., bile salt litmus broth containing lactose, saccharose, dulcite, adonite and inulin respectively; and Voges and Proskauer's reaction (reddish colour on adding caustic potash or soda to a glucose peptone culture of the organism tested). Of ten organisms of the *coli* group isolated from the hospital sewage, four were atypical *coli*, one was *B. lactis aërogenes*, two were atypical *B. lactis aërogenes*, one belonged to the Friedländer group, one was *B. cloacæ*, and one atypical *B. cloacæ*. Curiously enough, no typical *B. coli* was found amongst this collection.

For the coliform organisms present in drain air, plates of suitable culture media were exposed in January and November for one hour, and in June for half an hour, in the arched passage leading from the manhole to the main drain in Little Britain. In the January observation four colonies of typical *coli* were obtained, three colonies of atypical *coli*, two colonies of typical and ten of atypical *B. lactis aërogenes*, five of typical and two of atypical *B. cloacæ*. It is evident that these organisms are to a great extent identical with those found in the sewage: "at least six of the types present absolute identity throughout all thirteen tests; there can be no doubt that they represent the same organisms, and it is evident that organisms identical with those of sewage were obtained in rich abundance from the air of the drain." The other two observations were not so fully carried out in detail.

The conclusion is that "from the air of a large drain it is readily possible to isolate members of the *B. coli* group in numbers, and in considerable variety, by the aid of suitable methods. Such bacilli clearly correspond, on the whole, in their biological characters with those of the sewage flowing along the drain. From the fresh air in the vicinity these bacilli can only be obtained in extremely scanty numbers." Therefore they must have been derived from the sewage and not from the fresh air.

In the last section of his report Dr. Andrewes describes two experiments carried out with *B. prodigiosus*, confirming the results obtained by Major Horrocks (see this JOURNAL, October, 1907). Dr. Andrewes

expresses the results as follows: (*a*) In the drainage system of an ordinary private house sufficient splashing occurs to permit of the ready disengagement of bacteria from material passing down soil-pipes; (*b*) such disengaged bacteria may be carried along a 4-inch drain, against the flow of sewage, by the air currents in ventilation, for a distance of at least 50 feet."

The whole of the evidence in this research is harmonious; the observations all point to the same conclusion, and this is, that under certain circumstances, at all events, sewage does give up its bacteria to the air of sewers and drains. Such bacteria may form but a small proportion of those present in such air; but the use of selective media has enabled them to be discovered, so far, wherever sought for.

We believe that the great majority of sanitarians will now be convinced that drain air is a possible, and probable, means by which specific disease may be disseminated; that it is dangerous, and must be absolutely cut off from the air of dwellings; and that, therefore, the disconnecting trap at the junction of sewer and house drain is a necessity.

Dr. W. G. Savage contributes a study on the Bacteriology of Milk from Healthy and Diseased Cows. The milks of fifty healthy cows were examined individually. Several varieties of streptococci were found to be present, the group most commonly met with being a long-chained form, fermenting lactose, saccharose and raffinose, coagulating milk and usually fermenting salicin; none of the forms found were pathogenic to mice; several forms of staphylococcus (white, brown, yellow and semi-translucent colonies) were found, also non-pathogenic to mice. From the milk of six presumably healthy cows bacilli were isolated, morphologically and in some of their cultivation characters resembling the diphtheria bacillus; they were non-pathogenic to mice, and apparently devoid of significance. Out of fifty-two samples *B. coli*, or any glucose-fermenting organism, was only found in four instances; in one case it was probably present in the milk itself, before it left the teats, in the other cases it was probably due to accidental infection, strict aseptic precautions not being taken. With regard to the presence of leucocytes, Dr. Savage considers that "more than 800 per cubic millimetre warrants a careful enquiry into the existence of local conditions." He did not find that the presence of streptococci was in any way associated with the number of the leucocytes in the milk; but he did find that an excess of leucocytes is "seemingly definitely related to some present physiological or pathological condition, or to some antecedent pathological condition," *e.g.*, old injury or inflammation.

Six cases of "garget" were examined bacteriologically and cytologically; garget is a mastitis, by no means rare in milking cows; milk from cows so suffering has been considered to give rise to outbreaks of sore throat. In two cases a streptococcus was found in the milk, agreeing in its characters with *S. anginosus*, described by Andrewes and Horder in 1906 as "frequent in sore throats, and as having a special connexion with inflammation of the fauces and with scarlet fever."

Dr. Savage also discusses the most suitable methods for the isolation of the Gaertner group of micro-organisms, including the principal bacteria concerned in cases of meat poisoning, and the organisms of hog cholera

and paratyphoid fever; after which he gives the results of examination of the intestinal contents of certain presumably healthy animals.

The details as to laboratory methods are very clearly set forth, and deserve the careful attention of all workers in this branch of bacteriology. After considering the various methods available for isolation of Gaertner organisms from animal excreta or intestinal contents, Savage draws the following conclusions:—

(1) Animal inoculation methods are not trustworthy; that is to say, because members of the Gaertner group are isolated from the organs of a recently inoculated animal, it is not necessarily the case that these organisms were derived from the inoculation; instances are adduced to the contrary.

(2) Fuchsin agar and lactose bile-salt neutral-red agar sharply differentiate Gaertner organisms from *B. coli* organisms, and are of great value.

(3) Malachite green (0·05 per cent.) powerfully inhibits *B. coli*. Dulcite malachite green broth is very successful in isolating Gaertner organisms.

(4) There is a possibility, however, that not all the members of the group will flourish in this medium, therefore direct plating should also be employed, at any rate provisionally.

(5) The best method for the isolation of members of this group is a combination of direct plating of the material, adequately diluted, upon suitable media, such as fuchsin agar (F.A.) and lactose bile-salt neutral-red agar (L.B.A.), and incubation of some of the material in 0·05 per cent. malachite green dulcite broth for twenty to twenty-four hours, with subsequent distribution over plates of the same solid media.

Method of preparation of *dulcite malachite green* (0·05) broth : Liebig's extract 10 grammes, peptone 10 grammes, NaCl 5 grammes, boiled up with one litre distilled water; the mixture filtered and made up accurately to a + 1 per cent. reaction, and dulcite 5 grammes added; then 0·5 gramme powdered malachite green very accurately weighed and added. The mixture, usually slightly turbid, is steamed for thirty minutes and again filtered. It is tubed (10 cc.) and sterilized for thirty minutes on two successive days. N.B.—That all the malachite green is dissolved before the second filtration.

Modified Fuchsin Agar.—Peptone 10 grammes, Liebig's extract 10 grammes, NaCl 5 grammes, are boiled in enamelled dish with 1 litre distilled water; the mixture poured into a flask, powdered agar 30 grammes added, and the whole heated in autoclave at 115° C. for one hour; the flask cooled to about 60° C., and the white of one egg mixed with a little distilled water added. Heat in current steam, filter, and make up to a litre. Neutralise to litmus. Add 19 cc. normal soda carbonate solution and chemically pure lactose 10 grammes. Replace in steam steriliser for thirty minutes. A precipitate forms and the mixture must be again filtered. Then add fuchsin solution (see below) 7 cc., followed by 25 cc. of sodium sulphite solution (10 per cent.) quite freshly prepared. The mixture becomes much less red. It is then put conveniently into small flasks, each containing 50 to 60 cc., and sterilised in current steam for thirty minutes on two successive days.

Fuchsin Solution.—To 3 grammes powdered fuchsin in a dry flask add

60 cc. absolute alcohol. Mix well, stopper tightly, and let stand for exactly twenty-four hours at 20° to 22° C. Decant the alcoholic extract into clean stoppered bottle ; this keeps well, so that the same quantity of fuchsin is added to each batch of medium prepared, a matter of much importance. The medium must be stored in the dark, since light generally turns it red ; when solidified, it is almost free from colour.

The *lactose neutral-red bile salt agar* was made in the usual way ; the plates must be thoroughly dried.

N.B.—On L.B.A. colonies of *B. coli* are bright red, those of *B. gaertner* and other non-lactose fermenting organisms are white. On F.A. the *B. coli* colonies are also bright red, the non-lactose fermenters are colourless or faint pink.

The results of the examination of the intestinal contents of certain presumably healthy animals were as follows :—

(1) In none of the three bullocks examined were organisms remotely resembling Gaertner group organisms met with.

(2) In six pigs examined non-lactose fermenters were fairly numerous. Organisms culturally resembling paratyphoid A sub-group were isolated from five pigs, and when present were moderately numerous. Only four organisms were isolated which were culturally allied to the other and more distinctive Gaertner sub-groups, while these on closer examination could be distinguished culturally ; since the one did not ferment dulcite, while the other three fermented saccharose, a character not possessed by the known members of this group.

(3) All the organisms isolated from the pigs failed to be agglutinated by sera obtained from rabbits immunised from well-known members of the group.

(4) The only calf examined showed, both in its colon and cæcum, numerous organisms, which, culturally, were indistinguishable from the ordinary Gaertner group bacteria, and which possessed a high degree of pathogenicity.

When tested against the different immune sera these organisms failed to react with any one of them, and must be provisionally assumed to belong to a separate sub-group. How far they are common in calves' intestines, and to what extent they are a menace to the health of those using such animals, requires further elucidation.

The Micro-organisms associated with Rheumatic fever and Malignant Endocarditis have been studied by Dr. T. J. Horder. These diseases are admittedly ill-understood as to their etiology, and the present contribution is a distinct step in advance towards a knowledge of the subject. Negative results only were obtained on bacterial cultivation of the blood during life ; or of the heart's blood, endocardial vegetations, and pericardial and pleural exudates *post mortem ;* except in a few cases, in which streptococci, having no special features, were isolated *post mortem.* On the other hand, blood from cases of malignant endocarditis, taken during life, yielded positive results in twenty-seven out of thirty cases (90 per cent.). These organisms are not terminal infections (for they may be obtained from the blood early in the illness), nor are they incidental transient infections, for they may be cultivated repeatedly from the same case at intervals ; they are causal elements in the disease. Streptococci

occur most frequently, being found in 77 per cent. of the cases examined. Pfeiffer's *B. influenzæ* occurred in 6 per cent. of the cases. The streptococci are not *S. pyogenes*, but of the *salivarius* and *fæcalis* types, differing little, if at all, from the saprophytic streptococci of the mouth and intestine; they are but feebly pathogenic to mice; but when isolated from cases of malignant endocarditis can reproduce the disease if injected intravenously into rabbits, being recoverable from the lesions that result, and then yielding the same reactions as the original cocci. Saprophytic streptococci from human saliva and fæces cause endocarditis when injected intravenously into rabbits, and do this more readily than *S. pyogenes* or the pneumococcus. As Dr. Horder observes, this is significant, as showing that no sharp line can be drawn between "pathogenic" and "saprophytic" micro-organisms. "Or, again, the virus of rheumatic fever may not be of microbic manufacture at all. The problem is difficult, and its final solution has not yet arrived."

The volume concludes with two short preliminary reports, one on *S. fæcalis* and its chemical products, by Dr. Sidney Martin; the other on the results of sustained subjection of glycerinated calf lymph to temperatures below freezing point, by Dr. Frank Blaxall and Mr. H. S. Fremlin.

We cannot conclude this imperfect notice without acknowledgment of the extreme care that has been taken in the printing and proof-reading of the volume under review, full of tables and technicalities as it is. "Anærobic" has been allowed to slip through once or twice; and we would protest against the barbarism "immunology" on p. 141. Except for the absence of the detailed reports of sanitary investigations that has already been referred to, the present volume is fully equal in scientific interest to any of its predecessors. It is obtainable from Wyman and Sons, Fetter Lane, E.C., or through any bookseller, for 1s. 9d., and should be studied by all medical officers interested in pathological or sanitary progress.

Diseases of the Eye. By M. Stephen Mayou, F.R.C.S. London: Henry Frowde, Hodder and Stoughton, 1908. Price 5s.

This book is the latest addition to the series of the Oxford Medical Manuals. The author indicates the intended scope of the work in the preface, where he states that it "is written with the object of presenting to students who are beginning the subject, and to practitioners, a short practical manual of the diseases of the eye."

It is a readable little book and is eminently practical, the author, as a rule, confining himself to an account of one definite line of treatment or theory for each disease. He is always clear in his statements, and the work should certainly prove useful to the extent claimed for it. The chapter on elementary refraction is particularly clearly expressed, and should be of great assistance to the student who is commencing this branch of his studies. In the last chapter is given a brief account of some of the more common operations. The article on cataract extraction should have some account of the accidents that are liable to occur during and after the operation.

There is a small Ophthalmic Pharmacopœia contained in the appendix, which should prove useful. S. A. A.

Vaccine Therapy and the Opsonic Method of Treatment. By R. W. Allen. Second Edition. London: H. K. Lewis. Pp. xii. and 244. Price 7s. 6d. net.

A book dealing with the scattered information as to this latest addition to our therapeutic resources has been much needed, and the fact that a second edition has been called for in less than a year is sufficient evidence that Dr. Allen's book has filled a distinct want. The earlier chapters deal in detail with the technique of opsonic estimation, preparation, and administration of therapeutic vaccines, and with theoretical considerations bearing on the subject. This is followed by details and cases from which one can impress oneself as to the actual practice of vaccine therapy, and its results in the hands of its chief exponents. The mass of detail which it has been necessary to handle perhaps explains the somewhat confused arrangement and frequent repetitions of the earlier part of the work. In the pages dealing with technique, it would have been an improvement to have inserted a few illustrations of the apparatus and method of handling it. This is especially needed in the description of the method of taking samples of blood, an apparently simple operation which seems to offer insuperable difficulties to many practitioners. It might, also, have been well to mention that it was necessary to take samples of normal blood at the same time as the patient's sample. Another great difficulty to beginners is the staining of films prepared for estimating the opsonic index to tubercle, overheating the stain and the use of too strong acid, such as the 20 per cent. sulphuric acid recommended by the author, generally result in the destruction of the outlines of the phagocytes, except in experienced hands. The technique of preparing the vaccines is open to considerable criticism. It is recommended to add the preservative to the culture before heating. This would appear very likely to result in a considerable destruction of the efficacy of the vaccine, if the findings of ourselves in the case of typhoid vaccine, and of Haffkine in that of plague vaccine, are applicable to other organisms. The temperature laid down is that which is sufficient to kill the microbes in water, not in an antiseptic solution. Then, although the author recognizes the inadvisability of heating the vaccine too much, he recommends an exposure of the mixture of germs and antiseptic to 60° C. for one to one and a half hours, when fifteen minutes in saline only would suffice for almost any one used; and, not content with this, after tubing his material he again exposes it to 60° C. for an hour, and "if in doubt" (*sic*) as to sterility, gives the material even a third heating. With all this there is no mention of any routine verification of the purity of the culture used, or of the sterility of the vaccine after use. These are simple procedures, and cannot be omitted with safety from any process involving the injection of bacterial products into the human body; moreover, their adoption would save the necessity for exposing the vaccine to the extremely rough treatment recommended by the author. The method of heating the culture along with the antiseptic, and for such long periods, may, perhaps explain why Dr. Allen has been able to inoculate so large a dose as 300,000,000 *micrococcus catarrhalis;* a personal experience of our own with a dose of 100,000,000 (killed before the addition of the preservative, and with a minimum exposure to heat) taught us considerable respect for this organism, resulting as it did in incessant rigors, vomiting, and a most

intense headache for twelve hours. The same vaccine in doses of 20,000,000 is taken with impunity, and with very satisfactory results in the way of aborting a threatened cold or cutting short the muco-purulent stage of one already established. The maximum dose of T. R. is given on p. 125, as 0·5 cc.; on p. 128, it is stated that the dose is rarely raised above 0·0002 cc. This is apt to lead to confusion in the mind of the practitioner unless he happens to know that the two doses represent the practice of two different schools.

We note that the clinical effects of anti-typhoid vaccine given on p. 199 are not correct. It is very rare for a patient to have to go to bed after the first dose of the vaccine now used; moreover, the effects of the second dose are, as a rule, practically the same as those of the first.

The remarks on p. 40, with regard to those who have thrown doubts on the reliability of the "opsonic index" appear to us to be unnecessarily savage and in questionable taste. The author seems to have forgotten that some of the criticisms were based on counts of films, made and stained under circumstances to which the most pronounced enthusiast could not take exception.

The book contains a mass of information which could not be obtained elsewhere without prodigious labour, and, if one keeps in mind that it is written by an enthusiast, it is a good guide to the present position of vaccine therapy, and indispensable to those who undertake either the manufacture of therapeutic vaccines or their administration.

W. S. H.

Lessons from 100 Notes made in Peace and War. By Major-General E. A. H. Alderson, C.B., p.s.c., Commanding 6th (Poona) Division. London: Gale and Polden, Limited, 1908. Pp. 128. Price 2s. net.

This little book, written by a keen and practical soldier for the benefit of his brother-officers, contains much useful and sound advice. There is a good deal of the personal note throughout, but the author explains this in his preface.

The book consists of 100 headlines and quotations from widely different sources ranging from "Holy Scrip" to "Facey Romford"; followed by full explanatory notes as to the bearing of the same on the life and training of the soldier in peace and war. Presumably, in Note 2, the author does not include the army medical officer, say, in command of a mobile medical unit in the field, under the heading of "the doctors who have all hard and fast rules laid down in black and white for their guidance, and cannot go very far wrong," but reckons the army surgeons as soldiers rather than professional men in the responsible and varied work demanded from them on active service which, in many instances, certainly calls for, initiative and self-reliance in the highest degree.

Perhaps the most useful things in the book for medical officers are the notes on orders, and how to compile the same, as laid down in appendix "A." Now that senior officers of the Corps are frequently called upon to take part in Staff Rides, it is absolutely essential that they should be able to write their orders clearly and properly, and know how to do so on service, when the occasion arises; and though full instructions are laid down in Combined Training on these points, still further explanatory notes are very acceptable, and the above are excellent, and may be perused with advantage by medical officers of all ranks.

C. E. N.

Guide to Promotion for Officers in Subject "A." By Captain R. F. Legge, Leinster Regiment. London: Gale and Polden, Limited, 1908. Pp. 172. Price 4s. net.

An encyclopædia of general information likely to be useful to all Company officers. It is simply an epitome of various books and regulations dealing in subjects connected with Company work.

We consider that the volume could be much improved by the removal of the list of the various publications issued by Messrs. Gale and Polden, which occupies a quarter of the book, and the substitution of an index.

J. D. F.

How to Instruct in Aiming and Firing. By Quartermaster-Serjeant-Instructor J. Bostock. London: Gale and Polden, Limited, 1908. Pp. 77. Price 6d. net.

This little book is hardly likely to be of use to officers and men of the Royal Army Medical Corps. It is essentially a book for the combatant branch of the Service. J. D. F.

The Ophthalmic and Cutaneous Diagnosis of Tuberculosis. By Dr. A. Wolff-Eisner. Translated by Bernard I. Robert. John Bale, Sons and Danielsson, Ltd., 1908.

The method of diagnosis of infections by means of local reactions is becoming a matter of daily routine. The work before us embodies the author's own observations and a review of the literature of the subject, to which 228 references are given.

In carrying out Von Pirquet's cutaneous reaction a drop of Koch's old tuberculin, or a dilution of it, is placed on the cleansed forearm. By means of a boring motion of a rough point introduced through the drop a slight abrasion of the skin is produced. A small pad of cotton-wool is applied for ten minutes. In tubercular subjects the area will become reddened in four to twenty-four hours.

Calmette's test, as it is frequently called, though Wolff-Eisner claims to be the discoverer of it, consists in installing a minute drop of a 1 per cent. dilution of old tuberculin into the conjunctival sac. Redness of the conjunctiva ensues in twenty-four hours if the reaction be positive.

Wolff-Eisner observed that in twenty tubercular patients in the first stage of the disease the cutaneous test was positive in sixteen, and the ophthalmic in fourteen. Of twenty-six cases of tuberculosis in the second stage, eighteen responded to the cutaneous and fifteen to the conjunctival reaction; while of eighteen in the third stage only three gave a positive skin reaction, and five a positive conjunctival reaction. Calmette reported at the International Congress on Tuberculosis, held at Washington last October, that 92 per cent. of 2,894 clinically tuberculous patients responded to the conjunctival test; 57 per cent. of 1,081 persons, in whom tubercle was suspected, reacted; 17 per cent. of 2,328 apparently healthy, or without suspicion of tubercle, responded to the test. Von Pirquet, who has made use of either undiluted tuberculin or of a 25 per cent. solution, has obtained positive cutaneous reactions in 87 per cent. of infants manifestly tubercular, and in 20 per cent. of those clinically free from tubercle. The test has always been negative during the first six months of life. From that age onwards the curve rapidly rises until 55 per cent. of apparently tubercle-free children, aged from 10 to 14, react. Von Pirquet's curves agree closely with those of Hamburger, who investigated the presence of tubercle, latent and manifest, in 848 autopsies of children.

Wolff-Eisner advocates that dilutions of $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$ of tuberculin should be employed simultaneously in carrying out the cutaneous test, since he maintains the action is quantitative. Detre has observed a positive skin reaction with $\frac{1}{1000}$ tuberculin of bovine origin, though human tuberculin failed to react on the patient in this dilution. He therefore inferred that the infection was of bovine origin. Wolff-Eisner dwells on the diagnostic and prognostic value of the test if thus applied quantitatively. He describes a normal cutaneous reaction as one in which redness becomes apparent in four to six hours after the application of the tuberculin, and reaches its maximum after twenty-four hours, to disappear on the third or fourth day. This type is found in tuberculosis of the first and second stages, and indicates a favourable progress. A rapid and weak reaction—which may be overlooked, since the maximum is reached in about twelve hours and no trace is left on the second day—is significant of the third stage of tubercle, or of those cases which run an unfavourable course. A late reaction, lasting some days or more, represents healed or inactive tubercle. This, too, applies to the conjunctival test. Calmette also notes that cachectic patients, and those suffering from miliary tuberculosis or tubercular peritonitis, give no—or at most, feeble—ophthalmic reactions. In employing the conjunctival test it is incumbent on the surgeon to avoid the use of too low a dilution of tuberculin, or of too large a dose. Grave results have been reported chiefly on this account. Calmette states that in 6,303 tests, three cases of keratitis, twenty of conjunctivitis, and seventy-two instances in which the reaction was prolonged beyond three weeks, were noted. If there be a suspicion of tubercular disease of the eye the dilution of the tuberculin instilled should be increased from 1 in 100 to 1 in 100,000.

The author devotes sixty pages to the thoeretical consideration of hypersensibility of the infected organism. There is much of interest in the subject of "anaphylaxis," or "serum disease," which is assuming greater importance day by day. Anaphylaxis may be described as vaccination reversed; that is to say, an animal in the state of anaphylaxis reacts much more markedly to the second injection than to the first. Thus, a guinea-pig is not affected in any way by introducing subcutaneously several c.c. of horse serum. If, however, a very minute quantity of serum, even so little as $\frac{1}{10000000}$ cc. be injected, a state of anaphylaxis is produced, and 5 cc. of serum given ten or more days later will cause death.

The author reviews other methods of diagnosing tubercle. The presence of tubercle bacilli in the sputum is a comparatively late phenomenon. Sputum in which lymphocytes predominate is suggestive of tubercle. The injection of tuberculin as a diagnostic method is widely practised in Germany. Wright observes the rise or fall of the opsonic index after the administration subcutaneously of $\frac{1}{10000}$ mg. of T. R. But both these methods have drawbacks. The difficulties of detecting early infiltration of the lungs by X-rays are great; hence we must fall back on the eye and skin tests for the earliest information. The author predicts that these specific reactions will be applied in the future to all men before enlisting in the Army and Navy; to candidates for life insurance; to inmates of public institutions, &c. It is certain we have now another weapon in our hands for the combat of tuberculosis.

C. B.

Current Literature.

Quarterly Report on the Progress of Segregation Camps and Medical Treatment of Sleeping Sickness in Uganda.—In writing the introduction to the last Quarterly Report on the Progress of Segregation Camps and Medical Treatment of Sleeping Sickness in Uganda (Quarter ending February 29th, 1908), Dr. A. D. P. Hodges, Senior Medical Officer, Uganda, says: "There is no doubt that the hopes expressed by Professor Koch and others, that atoxyl would prove a general and permanent cure for cases of sleeping sickness, must now be abandoned. Personally, I have never allowed myself to hope for a cure in more than a limited number of favourable cases. This may, I think, still be hoped for, though the time has not yet arrived when we can say with confidence that any apparent cure will remain permanent." The writer then goes on to instance two or three favourable cases of men apparently quite well as long as two years after the disappearance of trypanosomes from the blood upon undergoing the atoxyl treatment.

"The results obtained from atoxyl and mercury are at present more promising than those from the original atoxyl treatment. Further, the fact remains that trypanosomes are banished, for a time at all events, from the peripheral blood-stream, and the risks of infection are proportionately diminished in consequence."

With regard to ill-effects following the use of this drug he writes: "The complications such as blindness which have arisen during the administration of atoxyl and which appear to be, at anyrate in many instances, due to the drug itself or some faulty condition of it, have occurred in such a small percentage of the total number of cases treated that I do not think they can be allowed to weigh against the temporary benefits which resulted to the majority, and the possibility of the permanent cure of some, or against the importance of following to a definite conclusion the experiment which has already been carried so far."

The present condition of 1,135 patients under treatment in the camps on February 29th, 1908, is given in the report as follows: 292, or 25·5 per cent., have definitely improved and this improvement has been maintained; 94, or 8 per cent., have relapsed after a temporary improvement; 287, or 25 per cent., have continued in much the same state as they were on admission; 131, or 11·5 per cent., were absent from the examination; 331, or 30 per cent., are dead. Of these patients 634 were treated with atoxyl only, 501 with atoxyl and mercury.

A few cases have been treated with soamin, the action of which has been judged at least equal to that of atoxyl, a few with antimony tartrate, the result not being considered favourable. The report has been compiled by Captain A. C. H. Gray, R.A.M.C.

Wounds of the Joints during the Russo-Japanese War. Article in *Archiv für Chirurgie*, by Leon Bornhaupt.—The Red Cross ambulance to which the author was attached was at Harbin from March, 1904, to September, 1905; 3,950 patients were admitted, most of whom were cases of severe wounds. Out of 2,265 wounded, 157 were cases of wounds of joints, making a proportion of 7 per cent. of this class of

wound. In the war of 1870-71 the proportion was 4·1 per cent., while during the Spanish-American War it was only 2·5 per cent.

Among the 157 wounds of joints noted by the author, he observed eleven which were not direct wounds made by missiles, but were caused by splintering of the bone. Of these eleven cases, eight were in the knee, this joint having by far the highest proportion of wounds (54 per cent.). The wounds of other joints were in the following proportions: 20 per cent. in the elbow; 1 per cent. in the shoulder; 3 per cent. in the ankle; 8 per cent. in the hip; 4 per cent. in the wrist. The 157 wounds were inflicted in 108 cases by rifle bullets, in thirty-nine cases by shrapnel, and in ten cases by high explosive shell. Rifle bullets lodged in the wound in 14 per cent. of cases, and shrapnel in 2 per cent. Suppuration was very frequently caused by rifle bullets; 60 per cent. in the case of the ankle-joint, 7 per cent. in the shoulder, and 4 per cent. in the elbow. In the knee, the wounds healed in most cases without suppuration. Wounds caused by shrapnel are exactly contrary in effect, for those in the knee suppurated in 48 per cent. of cases, while the other joints healed without complications. Suppuration generally ensued if a fragment of the projectile remained in the wound; the author found this to be the case in the proportion of 60 per cent. The wounds which most frequently induced suppuration were those inflicted at close range, or by ricochets. In the latter case, the ball becomes distorted and sometimes having passed through various substances, such as saddle, water-bottle, &c., will carry a fragment of these into the wound. The author gives one such instance, where, on opening an abscess in the upper part of the hip, it was found to contain a bullet embedded in two silver roubles. Wounds with splintering were found to heal readily when not caused by shrapnel or high explosive shell.

Treatment on the field of battle and good means of transport are of great importance in wounds of this kind. The author found that some of his cases had received immediate treatment, but that want of transport had occasioned much suffering. He speaks highly of treatment by means of massage, begun on the fifth or sixth day, and of baths for the knee, the elbow, and the shoulder, and he recommends that a staff of skilled masseurs should be attached to each medical base.

He operated on 5 per cent. of his 157 cases, chiefly for suppuration. He made fourteen amputations, one disarticulation of the hip, and one of the shoulder. Resection of the elbow, shoulder, and ankle gave good results and caused no deaths. But it was otherwise with resection of the knee. The author found it impossible to operate except during the first day or two after infliction of the wound if he found the pus to contain streptococci; later, the only treatment of any use was amputation, when streptococci were found. In four operations for resection of the knee, a good result was obtained in one case only. The total number of deaths was seven, that is to say, 4·46 per cent.; two from wounds in the hip, and five from wounds in the knee. The mortality caused by rifle bullets was 2·7 per cent. Wounds in the joints caused by rifle bullets were treated in 8·3 per cent. of cases by resection; by amputation in 5·5 per cent.; the remaining cases by conservative methods. These figures are greatly in favour of the last-named method of treatment, and the author's opinion is that Bier's treatment by "hyperæmia" will be of much value in treating wounds of the joints in future. W. G. M.

Tetanus during the Russo-Japanese War. (Article in the *St. Petersburg Medical Journal*, by Otto Hohlbeck.)—The author was attached to the Tsarita's ambulance, and among the 1,162 wounded who received aid, there were fourteen cases of tetanus, with thirteen deaths. It was only after August, 1904, that cases of tetanus occurred, after the battles of Liaoyang, Shaho, Sandepu, and Mukden, in the following numbers:—

Battles	Wounded	Cases of tetanus	Deaths from tetanus
After Liaoyang (August, 1904)	66	1	1
,, Shaho (August and September, 1904) ..	70	2	2
,, Sandepu (January, 1905)	158	3	3
,, Mukden (February, 1905)	167	7	6

There must also be included 131 wounded brought in during the intervals between these battles, among whom there was one case of tetanus, making a total of 592 wounded, with fourteen cases of tetanus (2·3 per cent.). Of these fourteen cases only three were caused by rifle bullets, the remaining number being caused by large projectiles—five by shrapnel, and six by high explosive shell. The cases were brought in to the ambulance as follows:—7 six days after the battle; 3 three days; 3 four days; and 1 seven days. All had received first-aid, but no antitetanic injections. The first symptoms of tetanus became apparent:—Once on the 6th, 11th, 14th, 15th, and 18th days; twice on the 9th day; three times on the 10th day; and four times on the 18th day. With the exception of the one where the symptoms did not appear till the eighteenth day, all cases ended in death; eight during the first five days after appearance of the symptoms, and five in the course of the second week. The treatment followed was isolation, with large doses of chloral and morphine. Four cases received antitetanic injections on the first appearance of symptoms. These were subcutaneous, and 30 c.cm. were used. They gave no relief, however, from the symptoms, but actually seemed to aggravate them. Four other patients elsewhere were also treated with the serum unsuccessfully, and the author abandoned its use. It is to be hoped that preventive injections will give better results, but the author considers this method was not tried properly during the war. In any case, it would be impossible to use this treatment on the battlefield, as it is necessary to know exactly the right moment and the right patient to inoculate. It is not only open wounds soiled by earth which are likely to induce tetanus, but also wounds which contain fragments of clothing or of the projectile. It is, therefore, obvious that there would be a large number of wounded requiring this treatment, and it would be necessary to provide sufficient supplies of the serum.

Dr. Otto Hohlbeck's notes are of interest, when taken in conjunction with the article on the necessity of providing field medical units with antitetanic serum, by Med.-Major Vallet, of the French Army, which appeared in the *Archives de Med. et Pharm. Mil.*, and of which a *prècis* translation has already been submitted. (*See* JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, December, 1908.) W. G. M.

Malarial Fever in Beni-Ounif during 1907. (*Archiv. de Med. et Pharm. Mil.*, May, 1908, p. 353.)—In an article on the above subject, Med.-Major Folley gives the following conclusions. At Beni-Ounif the outbreak of malaria was proved to be connected with the presence of

mosquitoes in the neighbourhood. The only variety found this year was the *Pyretophorus chaudoyei*, whose agency in spreading malaria in the cases of the Sahara has already been brought to light. There is a remarkable synchronism between the appearance of this mosquito and the annual outbreak of malaria.

This year the military authorities prescribed the distribution of quinine to the troops, but however much this preventive measure is enforced, it is never thoroughly effective. One reason for its being only partially effective is the presence of a large native population, and although quinine is distributed among them, many will not take it, and they thus remain "reservoirs" of the malarial parasite. It is impossible to segregate the troops from the people, and even inside the garrison it is only possible to protect the hospital buildings from infection. This renders it all the more necessary to vigorously pursue the destruction of the mosquito itself, as this is the only part of the work which can give completely satisfactory results.

During the whole summer the neighbouring marshes of Oued Melias were covered with petroleum. The petroleum was renewed at least every five or six days, owing to the evaporation caused by the great heat. The work was very efficacious, but the complete destruction of mosquitoes could not be effected this year on account of the existence of numbers of plants in the marshes. For next year's campaign against malaria it is proposed to:—

(1) Begin the petroleum treatment very early, before the spring even, in order to destroy the hibernating females and the larvæ in which life may be latent.

(2) Set the native labourers at work to clear the bed of the marsh of vegetation, as this makes an impenetrable protection for mosquitoes and their larvæ.

(3) Dig out and level the bed of the marsh so as to destroy all deep depressions in which water remains during the summer, and make a small channel in order to carry off the surface water. W. G. M.

A New Method of Sterilising the Skin.—Dr. Antonio Grossich, of Fiume, describes a new method of sterilising the skin in the *Centralblatt für Chirurgie* of October 31st, 1908. He tried it first for accidental wounds, painting the skin for a considerable area round the wound with tincture of iodine, without any previous washing, then, after suturing the wound, he painted the line of sutures with the iodine and applied a sterile dressing; the hair was shaved off dry, if necessary. Wounds treated in this manner healed so constantly by first intention, that Grossich applied the same method to the preparation of the skin for operations; at first for minor operations, later for operations of all kinds. He finds that if the skin is washed immediately before the iodine solution is applied, sterilisation is not so certainly produced as if the iodine is painted on the dry skin, and he explains this by the fact that if the skin is soaked with moisture, and especially if soap is present, the alcoholic solution of iodine cannot penetrate so readily into the layers of the epidermis. He therefore has the patient bathed, when possible, the day before the operation, and uses only the tincture of iodine immediately before operating, painting it freely over the whole operation field, after previous dry shaving. A second applica-

tion is made after the patient has been anæsthetised, and a large sterile cloth with an aperture in it is spread over the patient and fixed to the skin round the site of the incision by forceps. After the completion of the operation the sutures are painted with the tincture of iodine, and sterile gauze applied. The results are perfectly satisfactory, and no harm is done even if a very large area of skin is painted. Slight desquamation follows, leaving perfectly normal skin beneath.

The method is worth knowing, as it may possibly prove of value in military practice. C. G. S.

The Army Medical Service of Servia. (*Deut. Militär. Zeit.*, July 5th, 1908.) — This service consists of three sections — medical, veterinary, and apothecary. The first section is composed of medical officers, assistants, and men, and the medical officers have the same rank, designation, pay, and authority as combatant officers. At the head of the service is the Inspector of the Army Medical Service, who is also head of the Medical Department of the War Office, and has the rank of lieutenant-general. He is assisted by an Army Medical Committee, which is composed of seven senior medical officers. This Committee advises the War Office, and makes recommendations in regard to medical matters.

The corps of medical officers is recruited from amongst qualified civil doctors. A medical officer receives his military training by serving six months in a military hospital, after which he has to pass an examination in military hygiene, the requirements of military medical service in time of peace and war, in administration, military law, map-making, &c. Should he fail to pass, he must serve another eight months in the hospital. After this course he becomes a surgeon-lieutenant, which rank he retains for at least three years. Before becoming a major he must pass another examination. To ensure a reserve of medical officers, the War Office makes yearly allowances to medical students who engage to go through a course of military training. In time of peace there is only one medical officer to each infantry regiment.

At present there are no medical corps non-commissioned officers, as the school in which they are to receive their two years' course of training is not yet opened. After leaving the school they are to serve four years as serjeants of the medical corps, and five years as hospital assistants of the second class; becoming, later, hospital assistants of the first class.

The medical rank and file consist of five companies who serve one and a half years. They are to receive four and a half months training in the medical school, and then serve in the hospitals and minor medical posts.

The military apothecaries are military officials who rank as lieutenants and majors; they are recruited from among graduates in pharmacy.

In each of the five divisional headquarters are permanent military hospitals with from 120 to 400 beds. The medical officers in charge are under the command of the General Officer commanding the Division, and they have the rank and authority of a major over the *personnel*, over all military persons who are receiving treatment in the hospital, and over the medical corps of the division. The direct command of the subordinate medical *personnel* is in the hands of an infantry captain.

In all other garrison towns there are small temporary hospitals with twenty to fifty beds. The medical officer in charge has the rank of

captain, and has authority over all the medical assistants in the hospitals, and generally over the regimental medical hospitals. In Belgrade there is a central army medical equipment depôt, with a principal medical officer in charge, and a central medical and surgical stores depôt with the senior apothecary in charge. These stores supply all the military medical institutions with material and medicines, and have on charge all the equipment for medical services. Each division possesses a divisional medical supply depôt.

Medical officers also work in conjunction with the conscription (recruiting) commissions. There are also supervision commissions composed of two or three medical officers attached to each divisional staff, who decide as to fitness for military service in case of doubt.

For training in special subjects of study, medical officers are sent to foreign universities for one or two years, as the Belgrade university has no medical faculty. The medical officers of the reserve are called in turn to take duty during the yearly manœuvres, in the place of medical officers belonging to the active service, for fifteen to thirty days.

The military medical service in war-time is organised on the same lines as the German Army. A medical battalion, *i.e.*, the equivalent of the British field ambulances of a division, is composed of seven sections of fifty men each. W. G. M.

Correspondence.

MILITARY PRISON DIETARIES.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—In the December issue of the Journal there is an interesting paper on "Military Prison Dietaries," by Lieutenant-Colonel A. M. Davies, R.A.M.C. (R). Colonel Davies gives the nutritive values of the four scales allowed by regulation, but does not mention two others, which are not at all uncommon in some of these institutions, namely, punishment diets Nos. 1 and 2. Punishment diet No. 1, consisting of 1 lb. of bread with water *ad. lib.* in twenty-four hours, is, of course, practically a starvation diet, and any man on it, even for a short time, is bound to lose weight. If Colonel Davies reads the Annual Report of the Inspector of Military Prisons and Detention Barracks, he will notice that the amount of punishment awarded in these places varies in a marked degree, and if he further analyses the nature of the punishments, he will probably find that when dietary punishment is the prevailing one, there also the loss of weight is very pronounced.

I think this will explain the variations in weights in different prisons and detention barracks which Colonel Davies finds is difficult to account for.

I am, &c.,

John R. Mallins,

Lieutenant-Colonel R.A.M.C. (R).

Margate,

December 14*th*, 1908.

ARTIFICIALLY PRODUCED CARDIAC BRUITS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—With reference to recent communications on the above subject from Captain Harding and Captain Davy, it may be of interest to note that whilst working in the children's department at St. Thomas's Hospital some years ago, I frequently had pointed out to me a "retraction murmur," systolic in time, heard over the manubrium, produced by throwing the head and shoulders backwards. It was thought to be possibly caused by the pressure of tuberculous mediastinal glands upon one of the large venous trunks. Since that time I have noted the same sign in young children whom I considered quite healthy.

For a period of some months about three years ago, I had the opportunity of examining all cases of invalids for cardiac trouble arriving at Netley, and on two occasions I noted "retraction murmur" against cases with systolic murmur heard over the manubrium, audible only when the head and shoulders were thrown back, much in the position of holding up the shirt to expose the chest for examination, a position that I have often seen used. In my private note-book I have marked these cases as "retraction murmurs," thinking that they were possibly analagous to the retraction murmur of children. I have failed, in these cases of soldiers, to detect any pulmonary mischief that might cause enlargement of the mediastinal glands.

It would be interesting to know if retraction of the head and shoulders can, by extension on the trachea and bronchus, cause any kinking of the pulmonary artery, and thus produce this sign which might be mistaken for an indication of serious disease.

I am, &c.

EDWARD L. MOSS,
Lieutenant R.A.M.C.

October 28th, 1908.

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Journal of the Royal Army Medical Corps.

Original Communications.

PRELIMINARY NOTE ON EXPERIMENTS IN CONNECTION WITH THE TRANSMISSION OF TICK FEVER.[1]

BY BREVET-LIEUTENANT-COLONEL W. B. LEISHMAN.
Royal Army Medical Corps.

THE main facts relating to the transmission of tick fever are now well established, but uncertainty still remains as to the precise manner in which the virus of the disease, the *Spirochæta duttoni*, is conveyed by the bite of the tick and, also, as to the nature of the process by which the hereditary infection of successive generations of ticks is brought about. It has been known for some time that the young ticks born from an infected mother were themselves infected, but Möllers[2] has recently proved that the virus may also pass to a second generation of ticks without a fresh infection of the parent.

Again, for those who hold, as I do, that the pathogenic spirochetes are protozoal in their nature, the missing alternation of generation, which analogy would lead one to expect in the Arthropod host, has not yet been observed.

For these reasons, as well as on account of the results of some previous work with the *S. duttoni*,[3] I endeavoured to obtain the material necessary for the investigations I had in view, and,

[1] The expenses of this investigation were in part met by a grant from the Royal Society.—W. B. L.

[2] B. Möllers, *Zeitsch. f. Hygiene*, Bd. lviii., p. 277, 1908.

[3] W. B. Leishman, *Lancet*, March 23rd, 1907, p. 806.

being fortunate in this respect, I have been working on the tick transmission of the disease during the last four months. The experiments are far from being concluded, but some of the results seem worthy of record in a preliminary communication, as they appear to me to throw some fresh light upon the subject.

Two years ago I received from Africa some of the ticks which transmit this disease, the *Ornithodorus moubata*, Murray, and endeavoured, by means of their bites, to infect susceptible animals, such as monkeys, rats and mice, but without success. A second consignment also failed. These ticks, however, furnished material for a study of their structure, and some of them laid eggs which hatched into young nymphs. A few ticks from these original consignments still remain and have furnished some control material in connection with the present investigations. I next communicated with the brother officer who had been good enough to send them to me, Captain Hallam Hardy, R.A.M.C., asking that the next batch should, if possible, be collected from native huts in which actual cases of the disease had occurred. This he most kindly did, and I have, within the last four months, received from him, from Nyassa-land, two batches of ticks collected under those conditions.

By the bites of these ticks, thirty-nine in one instance and eighty in the other, two monkeys became infected with tick fever, abundant spirochetes appearing in their blood after the usual incubation period of six days. The attack was fatal in each instance, the first monkey, bitten by the smaller number of ticks, succumbing during its second relapse at the end of the fourth week, while the other, presumably more heavily infected, did not survive its first attack, and died in ten days. Blood from these monkeys infected mice, and the strain of spirochete is now kept alive by passage through these animals.

A large number of ticks have been allowed to feed on these monkeys or on infected mice at times when spirochetes were abundantly present in the blood, and I had thus at my disposal the material necessary for the investigations. Many of these ticks, being fecundated adult females, oviposited two or three weeks after gorging with this infected blood and most of their eggs hatched out. They were kept in the dark at a constant temperature of 24° C. (Except where otherwise stated the ticks mentioned in this note were all kept at this temperature.)

When working with the earlier batches of ticks, those with which I failed to infect animals, the most careful examination of

the various organs and tissues failed to reveal the presence of a single spirochete; examination of many of the eggs laid by these ticks, and of larvæ and nymphs hatched from their eggs, was also negative in this respect. In the case, however, of a few of the unfed young nymphs, examined after leaving the egg (the larval stage of this tick being passed within the egg-case), I encountered some curious collections of chromatin granules within the protoplasm of some of the cells lining a tubular structure, which I have since identified as a Malpighian tubule. These granules did not resemble any cell granulations with which I was familiar, and I strongly suspected them to be parasitic in nature, but, in the absence of any proof of the ticks from which they were born having been infected, I could not, of course, attribute to them any connection with the *S. duttoni*. I may, however, anticipate the observations recorded below by saying here that I now consider them to have such a connection.

Numerous observations upon the later batches of ticks which infected the monkeys also proved negative as regards the demonstration of spirochetes in any part of their body-fluids or tissues, an observation which it was difficult to reconcile with the generally assumed method of infection, namely, that unaltered spirochetes are inoculated into the animal, probably with the salivary secretion, when the tick bites.

The principal work upon this subject is that of Koch,[1] who studied the disease in German East Africa in 1905. Koch found a very large number of the ticks infected in the districts in which he worked, as many as 60 per cent. in some instances, and appeared to have had no difficulty in detecting the presence of the spirochetes in the cœlomic fluid. He also dissected ticks at various periods after they had been allowed to feed upon infected animals, and described the passage of the spirochetes through the thin walls of the intestinal sac into the ovary. In the ovary he found that the spirochetes penetrated into the immature ova and, following the ova after they were laid, and the embryos developing inside them, he still encountered clumps of recognisable spirochetes up to a point at which cell growth became so vigorous as to mask them. These observations appeared definitely to explain the mechanism of hereditary transmission of the disease in the tick, although it still left uncertainty as to the manner in which the spirochetes gain entrance to a fresh host when an infected tick bites.

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[1] R. Koch, *Berliner Klin. Woch.*, p. 185, February 12th, 1906.

The only confirmation of this part of Koch's work which I have encountered is the statement of Carter,[1] that he had observed spirochetes in the fluid withdrawn from the egg with a fine capillary pipette in the case of a small percentage of the eggs laid by an infected tick. On the other hand, other observers who have searched for the spirochetes under these conditions have failed to find them.

Without presuming to question the accuracy of these observations, I can only record my own failure to find a recognisable spirochete in any part of the body of a tick later than the tenth day after it had fed on heavily infected blood; and a similar failure in the case of eggs, whether dissected out of the ovary or laid under natural conditions. It is probable that differences in respect of some factor, such as that of the temperature or the climatic conditions, may explain these divergent results. At all events, it will, I think, be clear from the following experiments that there is a possibility of another method of hereditary transmission, as an alternative process, if not as the common one.

As to the methods employed in the experiments, the various batches of ticks fed on the same animal, and at the same time, have been kept isolated, as well as the eggs laid by such ticks and the young nymphs hatched from the eggs. Glass bottles with flat bottoms, filled with slips of clean filter paper, answered the purpose well, and a dish of water was kept in the incubator to prevent the air from becoming too dry. The latter detail I found to be necessary to allow of the hatching of sufficient numbers of eggs. After feeding, the ticks were usually placed in a vessel containing a little dry sand for a couple of days, as they like to bury themselves in this after they have gorged and the sand absorbs the Malpighian secretion and the coxal fluid voided at these times; later, they were removed to the bottles to allow of better observation as to their progress, the easy collection of the eggs, &c.

In examining the eggs, these have been washed in normal salt and then crushed on a clean slide, and a film made of the contents. Immature eggs, dissected out of the ovary, were treated in the same way. Unfed young nymphs and larvæ were also crushed, as they are too minute for dissection.

Older ticks were pinned to blackened paraffin, and carefully dissected under the surface of salt solution, the isolation of the

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[1] R. M. Carter, *Annals of Tropical Medicine and Parasitology*, vol. i., p. 157, 1907.

various tissues and organs being greatly facilitated by the use of a binocular stereoscopic microscope. The various portions separated for examination were carefully washed and then spread out on slides if thin enough or, if too thick for this, were crushed with the flat surface of a surgical needle and films made from the crushed tissues. The various fluids or secretions were collected in capillary pipettes, and films were made from these in the usual way.

Examination of these was made either by the hanging drop method or after staining with my modification of Romanowsky's stain. In the latter case very deep chromatin staining was aimed at in all cases, and it was found necessary in most instances to wash the films after staining with a little 50 per cent. alcohol, as any trace of deposit added greatly to the difficulty of studying the extremely minute particles described below.

The observations so far made may now be briefly summarised as follows :—

(1) Spirochetes taken into the intestinal sac of the tick soon tend to lose their motility and, shortly after this, their characteristic appearance. I have never seen a motile spirochete in this situation, or, indeed, in any other, later than ten days after a tick has fed upon infected blood, and only rarely later than the third day.

(2) On the day after the tick has fed, the majority of the spirochetes are seen to have agglomerated into tangled masses, only those which are still isolated show any signs of motility. Shortly after this stage important structural alterations are manifest in stained specimens. These alterations appear to me to be of two kinds. First, the central core of chromatin substance shows evidence of segmentation into a number of definite rod-shaped blocks of chromatin, alternating with bands of pale blue substance. More rarely, the chromatin is broken up into deep-stained granules of oval or circular contour, which may be large enough to distend the spirochete at the point at which they occur. Secondly, in many instances there also appears a lateral swelling about the centre of the spirochete, which may attain a diameter of 1 to 2 microns, and is seen to contain one, or sometimes two, very deeply stained chromatin granules, apparently embedded in a pale, blue-staining matrix. A similar swelling is also sometimes seen at one pole of a parasite. The connection of the globular lateral swelling with the spirochete is at first sessile, but later becomes pedunculated, the body remaining adherent to the spirochete by a delicate pinkish thread.

The above morphological alterations are identical with those which I have observed in citrated blood containing either *S. duttoni* or *S. recurrentis* when such blood has been kept in the ice-chest for several days, and the forms which I found I demonstrated in June, 1907, at Edinburgh, at a meeting of the Pathological Society of Great Britain and Ireland. Similar changes have been reported in the case of these and of other spirochetes by various observers; thus, Breinl[1] has noted them in spirochetes within the spleen, marrow and liver of infected animals, Carter[2] has figured them in the spirochetes which he found in the eggs of infected ticks, and Dutton and Todd[3] have also reported similar changes of *duttoni* in the intestinal sac and the Malpighian tubes of *Ornithodorus*. I may add that my present observations upon the changes of the spirochetes in the tick were made in ignorance of this last-mentioned work, so that they afford an independent confirmation of some of the observations of Dutton and Todd.

The changes which I had before noted in citrated blood were always suggestive to me as foreshadowing a possible change of form of the spirochetes in their alternative host, and the fact that similar changes do occur in this host lends additional support to the view that they are the commencement of an actual change of development, and not degenerative in their nature.

(3) Following upon these changes the segments of chromatin are apparently liberated from the body of the spirochete within which they were formed, as they are next found free in the intestinal sac and its diverticula. They were abundant in the case of a tick dissected on the second day after feeding. They exhibit no motility, and vary in appearance from a minute granule, approaching the limits of microscopic visibility, to small rods, either curved or straight, resembling, respectively, cholera or typhoid bacteria, but somewhat smaller (fig. 1). They appear to consist mostly of chromatin substance, but, in some cases, a small portion of blue-staining matter was noted in connection with the chromatin. On first encountering these bodies in the blood-mass of the intestinal sac, which occurred before I had been able to convince myself of their association with the spirochetes, I suspected them to be bacterial, but attempts to cultivate them on the usual media failed.

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[1] A. Breinl, *Annals of Tropical Medicine and Parasitology*, vol. i., p. 435, 1908.
[2] R. M. Carter, *Ibid.*, vol. i., p. 157, 1907.
[3] J. E. Dutton and J. L. Todd, *Lancet*, November 30th, 1907, p. 1523.

At the time when these free bodies are in evidence in the sac a number of very faintly staining spirochetes are to be seen, possibly those from which the chromatin has been extruded.

(4) The character and rapidity of the changes mentioned above appear to vary with the stage of attack in the animal upon which the tick was fed, and may possibly be further influenced by the time which had elapsed since the tick last fed, and by the temperature at which it had been kept.

(5) Soon after the occurrence of the above changes, as a rule on the third or fourth day after feeding, numbers of chromatin dots and rods, indistinguishable from those just described, are met with in the two following situations—First, in the cytoplasm of the cells lining the Malpighian tubules. In this situation the granules are frequently seen to be arranged in small clumps, varying from 2 to 5 microns in diameter, and such clumps, when liberated from the cells by crushing or laceration, are seen to possess a certain amount of coherency, and, in some instances, especially in the early days after the tick has fed, a pale blue-staining matrix can be made out by appropriate staining. Such clumps are, however, better seen and studied in the second situation. Second, in the ovarian tissue and in the oviducts. In this situation the clumps of granules are sometimes extremely abundant, especially if the animal upon which the tick was fed was heavily infected. The matrix is often seen in films made by crushing this tissue, but more often the clumps of granules are found to be surrounded by a clear zone or halo, which is not affected by the stain.

Prolonged study of these granules, in specimens taken from infected ticks which were dissected at various intervals after feeding, has left no doubt in my mind that they are derived from the spirochetes ingested by the tick. The numbers sometimes found have also given me the strong impression that an actual multiplication of the granules takes place in these two situations. They are so minute that I have not yet been able to follow the details of such a process, if it occurs, but it would appear probable that the clumps mentioned may be the result of a process of shizogony, and that such clumps or rosettes break up when mature and liberate the individual segments or granules, which are then free to multiply afresh and to form new rosettes. It is, however, also possible that some of the clumps may represent a simple aggregation of the segments derived from a single spirochete which had reached one of these situations in its spirillar form. It may also be mentioned that two types of these clumps occur; in one, the commoner, the

collection of chromatin bodies is composed of granules showing the same variation of shape as occurs in the contents of the intestinal sac; in the other form, the granules are all coccoid in shape, and there are none of the curved or straight chromatin rods. The latter type are more frequently found to be embedded in an unstained matrix.

Control material, in the shape of ticks which are known with certainty *not* to be infected, is, unfortunately, wanting, for the reason that the whole of my ticks have either come from an infected district or have been born from mothers which might have been infected. The fact that the grandchildren of infected ticks have been found infective, although their own parents had been bred in captivity and had never fed on infected blood, makes it difficult to be certain upon this point in the case of the ticks in my possession. Again, the fact that some of these ticks have failed to infect animals by their bites, to my mind does not in any way disprove the possible existence of the virus of the disease in some part of their bodies. The temperature at which a tick is kept is known to be a factor, and one which I have personally confirmed, and doubtless there are others of which we are still in ignorance. In other words, they may be infected but not necessarily infective.

At the same time, I have been able to convince myself that some of the ticks of the first batch, which have been nearly two years in captivity, and have never succeeded in infecting an animal by their bites, do not show any signs of the clumps of granules described above, either in the cells of their Malpighian tubules or in the tissues of the ovary. Again, as will be mentioned in a later section, the inoculation of tissues containing the granules has been followed by infection, when certain conditions were observed, while inoculation of the same tissues which had shown no evidence of the granules was negative.

As to the channel by which the granules reach the above situations, assuming my views as to their origin to be correct, there is little difficulty. The Malpighian tubules of this tick, two in number, are exceedingly long and delicate, they wind throughout the tissues of the tick in a very complex manner, and are, at many points of their course, in the most intimate apposition with the receptaculum and diverticula of the intestinal sac and with the ovary and oviducts. The distribution of the granules in the Malpighian cells is also irregular, large areas may show none, while, a little further along the tube, the cells may be densely

packed with them (fig. 2). This would suggest that the actual penetration of the intestinal wall by the granules or spirochetes takes place only where it is in contact with the Malpighian tubes or the ovary.

(6) Neither the chromatin granules nor recognisable spirochetes have been found elsewhere in the body of an infected tick, although systematic search has been made for them in the following situations: (*a*) the cœlomic fluid; (*b*) the "fat-body"; (*c*) the salivary glands; (*d*) the "cephalic gland" of Christophers (this may possibly be identical with the structure recently named "Gené's organ" by Nuttall); (*e*) the coxal gland and coxal secretion; (*f*) the spermatheca; (*g*) the spermatophores; (*h*) the white secretion of the Malpighian tubules.

In the case of one infected tick, dissected on the fourth day after feeding, a number of short, curved, thread-like bodies were found in the ovary, associated with numbers of typical clumps of granules. The appearance and faint-staining properties of these threads suggested that they were either the remains of spirochetes from which the chromatin segments had been extruded, or, possibly, that they were young spirochetes derived from the granules. I have not encountered them again.

(7) A careful examination has been made of several hundreds of eggs which were laid by ticks known definitely to have been infected, or by such as had failed on some occasion to infect susceptible animals by their bites. In the great majority of the first class, those laid by certainly infected parents, I found clumps of the granules identical in every particular with those just described as occurring in the Malpighian cells and in the ovary. In a certain number, however, of the eggs of each batch laid by the same tick, none could be found. In the second class, those from parents which had not been proved to be infective, the clumps were also found, but in a very much smaller percentage of eggs. In some ticks of this class no granules could be found in any of the eggs examined.

Immature eggs have also been studied by careful dissection from the ovary under the microscope and, in many instances, the same clumps have been found in the egg-contents. In eggs of microscopic dimensions, 30 to 50 microns in diameter, one or more clumps have also been seen at times. In the case of one tick, infected by feeding four weeks before, which had been kept at a temperature of 37° C. before dissection, the granular clumps were more numerous; one ovum, indeed, of which I have taken a photograph

(fig. 3), showed a dense mass of the granules inside the limiting membrane.

Eggs laid by certainly infected females have been studied from day to day after they had been laid and, in the great majority, the clumps have been found, often in considerable numbers (fig. 4). At first they are seen to be free in the yolk, but, after a few days further development of the egg, when cellular multiplication becomes manifest, the clumps were found to have entered, or to have been taken up by cells of mononuclear type, with abundant and deep-staining protoplasm (fig. 5). Some of these were demonstrated at a Laboratory Meeting of the Pathological Section of the Royal Society of Medicine, held at the Royal Army Medical College on November 3, 1908.[1] From a study of more advanced eggs, of the embryo larvæ and of the young nymphs, I think that these cells are to be identified as the elementary constituents of the Malpighian tubules.

(8) Similar observations have been made, in great number, upon the larvæ and young nymphs hatched from these batches of eggs, and, in the majority, not in all, the same granular clumps have been found, invariably contained in the cytoplasm of the cells lining the short Malpighian tubules (fig. 6). Here there was no doubt as to the identity of the tubules, as the characteristic crystals of the Malpighian secretion were frequently observed within their lumen. I mentioned earlier the finding of certain curious aggregations of chromatin granules in similar tubes in dissections of young nymphs made about two years ago with the first batch of ticks; comparing these old specimens with those now in question the identity of the granules is manifest.

Animal Experiments.

(9) These are still in progress and it will suffice here to indicate their general character and the results of a few in which evidence bearing upon the mechanism of infection has been obtained.

The general idea of this part of the investigation has been to test the infectivity of the different fluids, tissues and organs of ticks at various stages of their development from the intra-ovarian egg upwards, controlling the results by a careful preliminary microscopical examination as to the presence or absence of spirochetes or the chromatin bodies which I consider to be derived from spirochetes. The tissues and organs have been isolated by

[1] W. B. Leishman, *British Medical Journal*, p. 1435, November 7th, 1908.

careful dissection under the microscope, washed thoroughly in several changes of sterile salt solution and then crushed in a watch-glass with a few drops of the salt solution. The resulting emulsion has then been inoculated hypodermically into white mice. The results of a few of these experiments may be briefly summarised.

A. In the following, the result of the inoculation was *negative*, the animal remaining free from spirochætosis.

(1) Emulsion made from the crushed ova laid by a tick not known to have been infected. The tick and the ova had been kept at 24° C. Neither spirochetes nor granules were found.

(2) Emulsion made from the Malpighian tubes of the same tick. Neither spirochetes nor granules found.

(3) Emulsion made from the Malpighian tubes of ticks (two experiments) known to have been infected and kept at 24° C. In each instance granules were present but no spirochetes were found.

(4) Emulsion made from the salivary glands of an infected tick which had been kept at 24° C. Neither granules nor spirochetes found.

(5) Emulsion made from the salivary glands of an infected tick which had been kept at a temperature of 37° C. for two days before dissection. Neither spirochetes nor granules found.

B. In the following, the result of the inoculation was *positive*, the animals contracting tick fever and showing abundant spirochetes in their blood.

(1) Emulsion made from the crushed walls of a diverticulum of the intestinal sac of an infected tick, together with a small amount of the contained products of digestion. The tick was one which had been fed upon a heavily infected animal a month before and had been kept for two days before dissection at a temperature of 37° C. No spirochetes were seen but a few granules were present.

(2) Emulsion made from the Malpighian tubes of the same tick. No spirochetes but abundant clumps of the granules were found.

(3) The white Malpighian secretion from the rectal dilatation of the same tick. Neither spirochetes nor granules were found, but the cells from the upper parts of the tube were filled with the chromatin granules.

(4) Emulsion made from a small portion of the ovary of an infected tick which had been kept at 37° C. for seven days. Clumps of granules numerous, but no spirochetes.

The above experiments are naturally of interest and lend some support to my views as to the nature of the granules I have described. Needless to say, they are being repeated and extended.

I may conclude with a brief *résumé* of the observations, with the reservation that I am well aware of the many points awaiting further proof and confirmation, and of the absence of any ocular demonstration of the development of spirochetes out of the granules so frequently alluded to.

(1) After the ingestion by the tick of blood containing spirochetes these soon lose their motility in the intestinal sac and, eventually, their characteristic appearance. Morphological changes occur in them which result in the formation and liberation of small chromatin bodies, rod-shaped, coccoid, or curved in form.

(2) No recognisable spirochetes have been seen in any portion of a tick later than ten days after it had been fed on infected blood, nor have any been seen in the egg of a tick.

(3) The chromatin bodies traverse the walls of the intestinal sac and enter, or are taken up by the cells lining the Malpighian tubules; they are also to be found in quantities in the tissues of the ovary and the oviducts.

(4) Multiplication of the bodies within the tissues of the tick appears probable.

(5) Some of the bodies derived from the spirochetes penetrate into the immature eggs within the ovary and have been found in all the stages of the further development of the eggs, as well as in the earliest embryonal cells.

(6) In the embryo tick, the bodies are taken up by the cells lining the primitive Malpighian tubules and they have been found in the Malpighian tubules throughout all the subsequent stages of the tick's life.

(7) Inoculation of crushed tissue containing the chromatin bodies, but no spirochetes, has resulted in the infection of the inoculated animal when the tick from which they were obtained had been kept at a high temperature for some days before dissection.

From the above observations it appears to me possible that natural infection of tick-bite occurs, not, as usually supposed, by the inoculation of unaltered spirochetes from the salivary glands, but through the agency of these chromatin granules, which may either be regurgitated from the intestinal sac or passed in the Malpighian secretion which is voided by some ticks when gorging. In the latter case such granules might readily gain entrance into the new host through the wound inflicted by the tick's bite.

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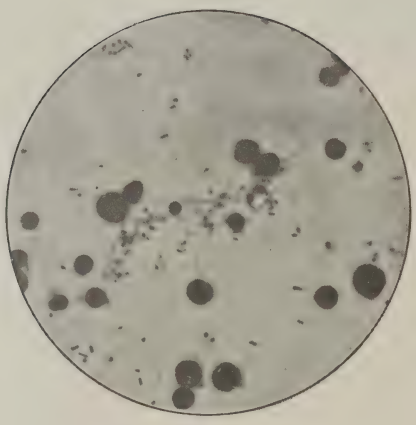

FIG. 1.

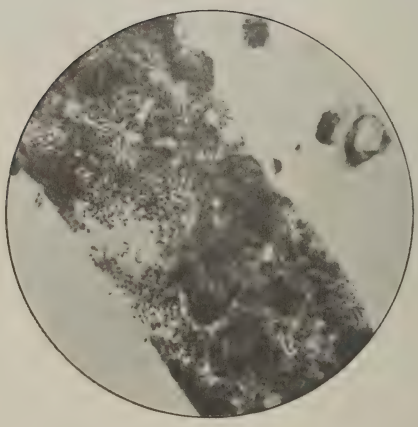

FIG. 2.

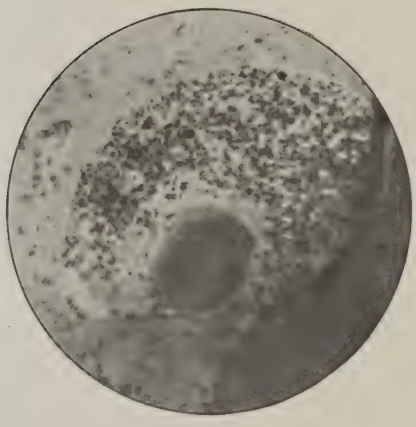

FIG. 3.

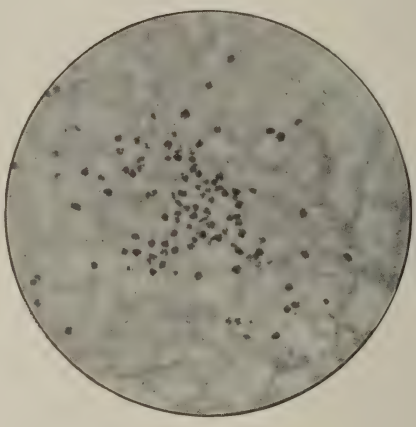

FIG. 4.

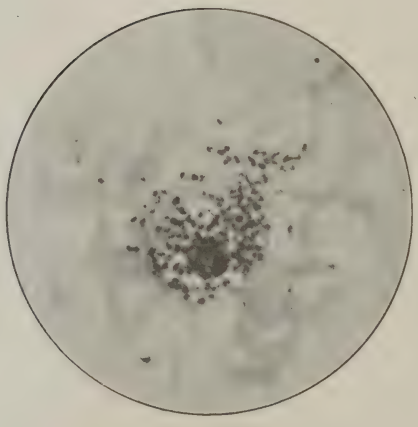

FIG. 5.

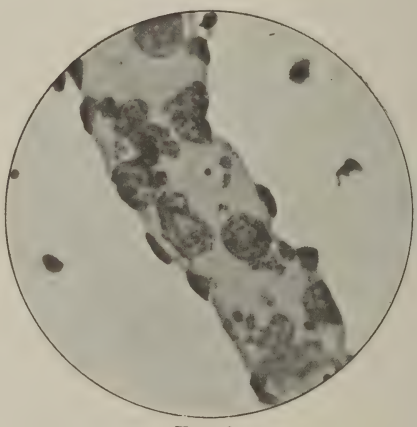

FIG. 6.

To illustrate paper on "Tick Fever," by Brevet-Lieutenant-Colonel LEISHMAN, R.A.M.C.

DESCRIPTION OF PLATE.

The accompanying photo-micrographs were taken with Zeiss' apparatus from films stained by Leishman's method.

Fig. 1.—Film made from the contents of the intestinal sac of a tick, two days after it had fed on heavily infected blood. The chromatin bodies are seen lying among the black granules of digested blood, also a few pale-staining spirochetes. Magnification, 1,000 diameters.

Fig. 2.—Malpighian tubule of an infected tick, six days after feeding on infected blood, showing masses of the chromatin granules in the cells. Magnification, 1,000 diameters.

Fig. 3.—Ovum projecting from the edge of the ovary, from a tick infected four weeks previously, showing many clumps of the chromatin granules within its substance. Magnification, 2,000 diameters.

Fig. 4.—Clumps of granules in a film made from an egg just laid by an infected tick. Magnification, 1,000 diameters.

Fig. 5.—Embryonal cell from an egg in a more advanced stage of development, showing numerous clumps of granules, many within the cell. Magnification, 1,000 diameters.

Fig. 6.—Malpighian tubule of a young unfed nymph, showing a few masses of granules in the cells. Magnification, 1,000 diameters.

PRELIMINARY NOTE ON THE USE OF ANTITYPHOID VACCINE IN THE TREATMENT OF ENTERIC FEVER.

By Captain A. B. SMALLMAN.
Royal Army Medical Corps.

With a Note by Lieutenant-Colonel W. B. Leishman, R.A.M.C.

At the International Congress of Hygiene and Demography, held in Berlin in September, 1907, a further communication on the treatment of enteric fever by means of an antityphoid serum was made by Professor A. Chantemesse (Paris). Lieutenant-Colonel W. B. Leishman, R.A.M.C., who was present at the Congress, published (Journal of the Royal Army Medical Corps, March, 1908), an account of Chantemesse's article, but it may, perhaps, be of benefit to recapitulate here some of the striking results obtained and the interesting statements made by Chantemesse for purposes of comparison with what follows hereafter.

In the first place, it is to be noted that Chantemesse treats his patients on the usual lines, with the one exception that he injects, subcutaneously, one, sometimes two, doses of his antityphoid serum. He does not use the cold bath treatment of Brand. His mortality figures are as follows: In the six years 1901-1907 there were 1,000 cases with 4·3 per cent. of deaths. Moreover, in those six years, among the cases treated by serum within the first seven days of the disease, there was no case of perforation and no death.

The figures of three other physicians using his serum are similar, and a comparison is also given between the mortality obtained by them prior to the use of the serum and that during its use, thus:—

Prior to use of serum	While using serum
I. 10 to 12 per cent.	3 per cent. (100 cases).
II. 10 to 12 ,, ...	4 ,, (200 ,,).
III. 10·6 ,, ...	5·5 ,, (90 ,,).

The mortality from the ordinary methods of treatment varies from 12½ per cent. to 20 per cent. By means of Brand's cold bath treatment mortality has been reduced in some cases to 7 per cent. The serum is prepared by the injection into horses, over a period of years, of the toxin obtained from the growth of virulent typhoid bacilli on a special medium.[1]

[1] For details on this and other points readers are referred to the original article, "Bericht über den XIV. Internationalen Kongress für Hygiene und Demographie," Berlin, September 29th, 1907, Band i., p. 195, or to Colone Leishman's article, referred to above.

His practice is to inject a few drops of the serum under the skin of the arm *as early as possible in the course of the disease.* He rarely finds it necessary to give a second dose; when he does so he uses half the amount. He has come to the conclusion from experiments in animals, and from phagocytic estimations in patients, that the good results observed are due to a process of "opsonisation," to an increased phagocytic activity on the part of those cells of the body which are concerned in increasing the resisting power of the patient. Accepting this explanation, the idea occurred to Colonel Leishman that the injection of doses of the ordinary prophylactic antityphoid vaccine ought to produce a similarly increased phagocytic activity and a corresponding amelioration in the course of the disease. The outcome of this was that Quetta was chosen as a suitable place in which to try the effect of such injections. In all, thirty-six cases have received therapeutic injections of the vaccine during the past five months, the observed effects of which may now be detailed. In the first place, it may be noted that the cases treated were diagnosed bacteriologically, in the main by means of Conradi's blood-culture method; two or three by isolation of the organism from the fæces. One exception to this will be noticed later.

The initial difficulty was the question of dosage. It was decided, in consultation with Colonel Leishman, to begin by giving that amount of vaccine which would contain, approximately, 100 million organisms. It was soon seen, however, that the effect of this amount on the course of the disease was in most cases slight or absent. Following the procedure of Chantemesse, second doses were given after an interval of nine or ten days in the earlier cases. Subsequently, the dosage was gradually increased and the intervals shortened, with the result that, in the later cases, good effects have been noted much more frequently.

The modifications in the course and terminations of the disease which have been observed up to the present are:—

(1) *Temperature.*—The first case which showed what, in the light of after experience, seems to be a typical good effect is that of No. 1. The dose being given in the forenoon, in the evening a rise of a degree or two is seen (stage of reaction). The following morning there is the usual fall, but this is found to become progressive for about three days; then the temperature begins to rise again in a fashion which recalls the usual method of onset of the disease. At the end of three days, if the good effect has been produced, comes what we now think to be the appropriate time

for the second dose. These effects will be specially well seen in the charts numbered 2, 3, 4, 5, and 6.

(2) *Appearance of the Patients.*—As insisted on by Chantemesse, they have an "unexpectedly good appearance," and it was no

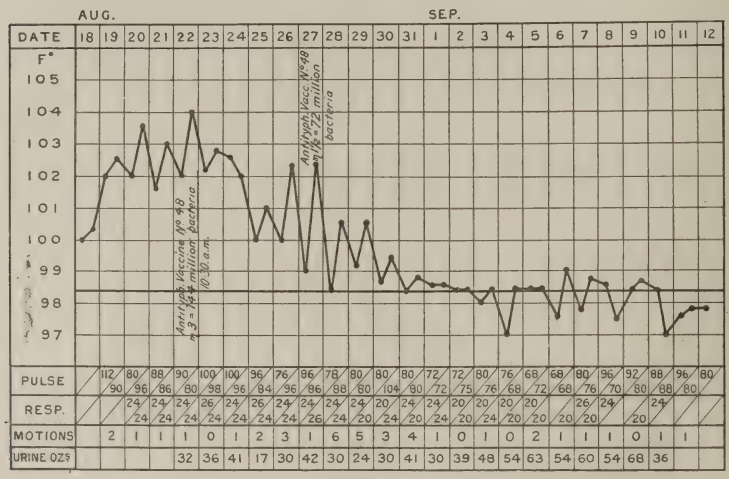

Chart 1.

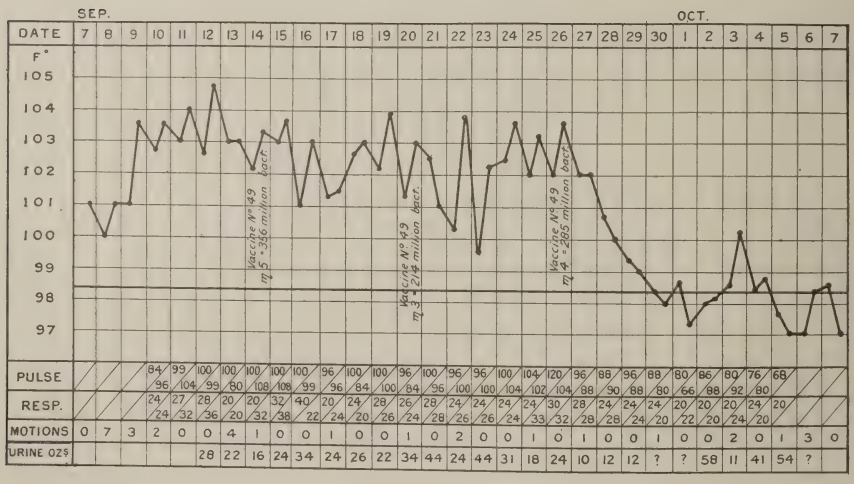

Chart 2.

uncommon thing to go into the ward when full and find nearly every patient quietly and comfortably sleeping. The "typhoid facies" was in most cases conspicuous by its absence.

(3) *Increased Amount of Urine.*—This, also pointed out by

Chantemesse, is apparently comparable to that usually occurring with the beginning of convalescence. It will be seen that, on the day after injection of the vaccine, the amount of urine was frequently doubled.

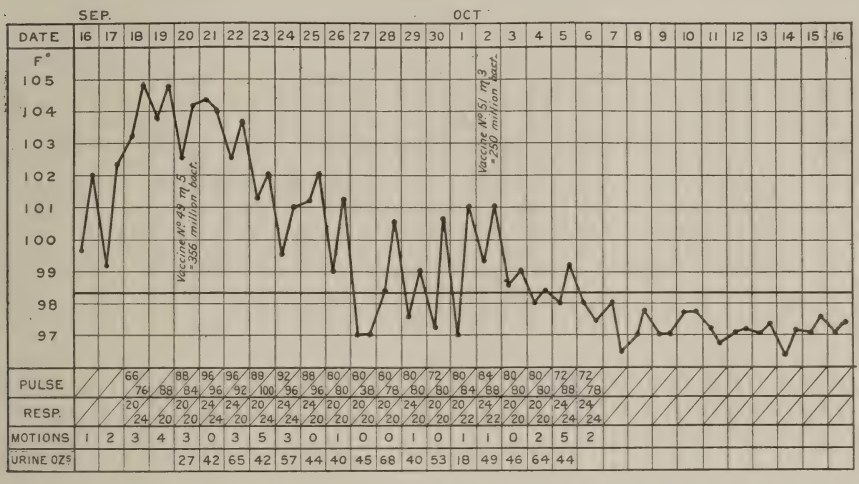

Chart 3.

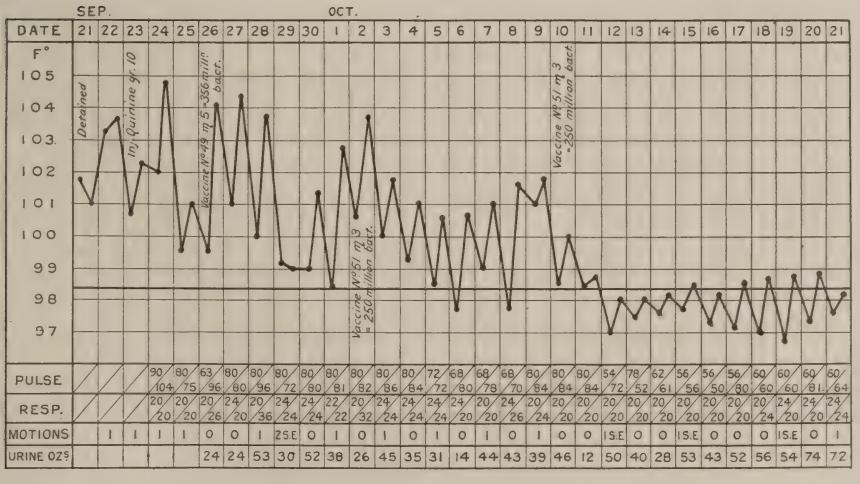

Chart 4.

(4) *General Effects.*—There has been an unusual absence of prolonged cases, of complications, of sequelæ and of relapses.

(5) *Low Mortality.*—Out of the thirty-six cases treated there

were three deaths, giving a percentage of 8·3. Of the three deaths, two were fulminating cases who died about a week after admission and who had received only one dose of vaccine. These will be

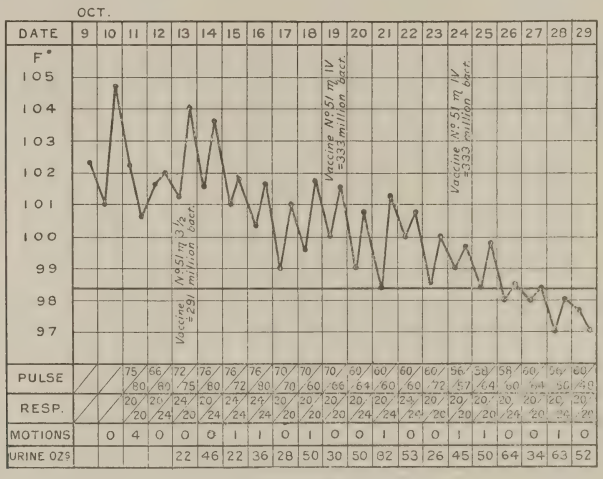

Chart 5.

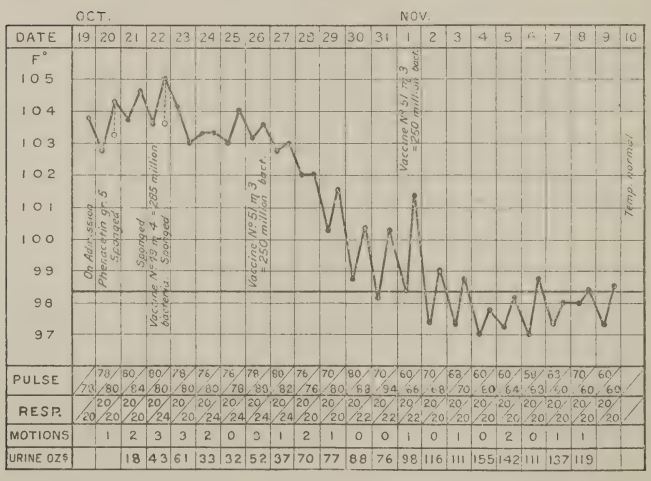

Chart 6.

referred to again later. In connection with low mortality the effect of prophylactic dosage with vaccine is to be remembered, it being now a well-established fact that an inoculated man usually has a very mild attack of the disease, should he become

infected. Four only of the cases in this series were inoculated men, one of whom perhaps may be left out as he apparently suffered from a paratyphoid infection and was not treated with vaccine.

(6) *Effect of Local Injection of Vaccine into Local Infections.*— In two instances there ha been, during convalescence, a commencing periostitis of the tibia. Both were treated, following Chantemesse, by the injection of 1 minim of the vaccine deeply, *i.e.*, to the bone, into the middle of the lesion. In the first case, situated in the upper third of the tibia, the effect was almost startling. The injection was given at mid-day. At 6 p.m. the pain suddenly disappeared and did not return. The redness and swelling were seen next morning to be increased, due, of course, to local reaction, but they both began to subside from that time, and in three days from the time of injection no trace of the lesion was left. The second case was not quite so striking, yet here again the pain suddenly diminished after about the same interval, but there was a (?) reactionary rise of temperature and the redness and swelling took about four days to disappear.

Everyone who has been concerned in the care of these patients has been quite convinced that the injection of vaccine does produce an undoubted good effect. Moreover, no bad results have so far been noted. The question of dosage, however, still remains. Undoubtedly, the scientific method of arriving at this, in any particular case, is by the frequent estimation of that antitropic substance which can be shown to be the best index as to the resisting power of the patient. Whether this will prove to be due to a bactericidal substance or to an increased phagocytic activity remains for further investigation. On the other hand, it may prove to be an increased activity in the fixed cells of the patient whereby they acquire a greater power of destruction of the infecting bacilli. There are at least two considerations which point in this direction, viz.: (1) the modern view that typhoid bacilli may live and multiply in an individual without his having enteric fever, and that he only has enteric fever when the bacilli overflow from the internal organs, the local manufactory, into the blood-stream; and (2) the fact that a local infection can be dissipated by the local injection of the vaccine.

Meanwhile it may be of use, to others who wish to use the vaccine therapeutically, to indicate the amounts which would appear from the experience of this series of cases to be safe and useful. The initial dose latterly used is 300 to 350 millions of

organisms, and as this sometimes produces a reactionary rise of temperature to 105° F., it would seem that perhaps this is a safe limit. It may be that Chantemesse's dictum, "the more ill the patient, the less ought to be the dose," would apply here. My experience up to the present is insufficient to enable me to say, though it may be noted that four or five fulminating cases, amongst whom the three deaths occurred, did not react to the vaccine in the typical way, although the dose varied in them from 100 to 356 millions. The natural assumption is, I think, that not enough vaccine was given, or that a second dose should have been given after a short interval. One should, perhaps, be guided mainly by the temperature chart; if no effect is produced in three days, another dose may be given. But the amount of variation, as regards dosage, seems to be as great as that in every other aspect of this variable disease. Thus in one case (chart 1) the effect was produced by an initial dose of 142 millions, followed in a few days by half that amount; whereas in another case the total amount given was over 1,800 millions, spread over seven doses; from which it would appear that the chief indication for dosage is to continue until the good effect is produced. It would also seem that Chantemesse's contention that, by giving a second dose after a short interval (or one large dose), one adds to the danger of the patient by setting free in his blood toxins in addition to those already circulating in it, does not hold good here, at all events, to the same extent. In this case, an amount was given in excess of that contained in the ordinary two prophylactic doses combined. It would also seem that here we have some corroboration of the statement made in the Aldershot work that no evidence of a "negative phase" was found. If one can give, during the course of the disease, without apparent bad effect, an amount larger than that of the ordinary prophylactic doses, it would appear that one can with safety inoculate in the presence of an epidemic, the chief argument against which was, that harm might be done by the production of a negative phase in an already infected individual.

Perhaps the best result in the series was that of an officer of the Royal Engineers (chart 6). He received the first dose of vaccine on the eighth day; the reactionary rise of temperature was to 105° F. After this a slight fall occurred and the temperature then continued at a slightly lower level for four days, when another dose was given; this produced a marked fall for four days to 99° F., after which it began to rise again; another injection, however, cut it short. The amounts given at each dose are shown on

the chart. This patient, when convalescent, volunteered the interesting statement that five or six hours after the first injection, although he felt cold and shivering (the time of the reactionary rise), he felt also a marked change in himself for the better. He did not have the same experience after the other two injections. This is corroborated to some extent by other patients asking to have the vaccine injected.

The constancy of this fall of temperature after injection of the vaccine is such that in one case it was useful as a means of confirming the clinical diagnosis. In this case one failed to isolate the organism from the blood or fæces. Clinically, the only indication was the high temperature, combined with a slow pulse. He was dosed on the twentieth day, the effect of which was to alter the character of the temperature for two days, after which the fall began, lasting for the usual three days or so. A second injection on the twenty-seventh day produced, again after a little delay, a fall to normal in three days. A relapse took place, and a third injection on the thirty-eighth day produced a fall to normal in five days. If other experience shows that the fall of temperature following an injection of the vaccine is fairly constant in typhoid fever and absent in fevers due to other causes, it may be that we have in the vaccine a diagnostic agent of no little value, comparable to the tuberculin reaction. Chantemesse has already shown that an ophthalmo-reaction is obtainable in enteric fever. Whether it may also prove to be of value in distinguishing between a typhoid and a paratyphoid infection remains to be seen. Unfortunately enough, in the only two doubtful cases of paratyphoid fever which have occurred here during this "enteric season," the vaccine was not used.

Another probable advantage accruing from the use of the vaccine is that, by continuing the injections into the period of convalescence, the number of relapses may be reduced.

The charts of the thirty-six cases show that there is little evidence, so far, of appreciable shortening of the disease below the classical twenty-one days. On the other hand, the number of prolonged cases is small. It is hoped that, by further experience and improved dosage, the duration of the disease will appreciably be shortened.

The vaccine used in these cases belonged to the batches numbered 48, 49, 51 and 53, and was used at no greater age than three months after manufacture, with the one exception, probably

unimportant, that for three days on one occasion, vaccine No. 49 was used when it was three months and thirteen days old.

The site of injection chosen was the one I am in the habit of using for prophylactic injections, viz., the extensor surface of the forearm.

The local effects produced by an injection are similar to, but slighter than, those caused by the usual prophylactic injections, and, as a rule, trouble the patients but little.

It may be contended that the evidence adduced in this short note as to the therapeutic value of the vaccine is inconclusive, and the experience too short to justify one in drawing any definite conclusions. But I think it will be agreed, at the least, that if by the injection of the vaccine in a small dose one can produce, with safety and with little discomfort, a fall of temperature for about three days, and that the process can be repeated several times, one is saving the tissues of that patient a considerable amount of wear and tear, and the conservation thus obtained may be vitally helpful to him in the later stages of the disease. If, moreover, one can cut short, in three or four days, a case of beginning periostitis, or other local infection, which might otherwise end in suppuration lasting for weeks or months, one is effecting something.

I greatly regret that time did not allow of my making phagocytic or other estimations of the blood of these cases treated by vaccine.

Some other points of interest which emerged in this series of cases, though not bearing on the subject of this note, may be quoted here. Of the four cases which had been previously inoculated against the disease, one nearly became an ambulatory case. Blood-culture on the fourth day after admission was negative, and the temperature fell to normal on the sixth day, but the organism was recovered from the fæces on the twenty-first day. In another, blood-culture was negative in the original attack, but positive during the relapse. In the third, the organism was recovered from the blood-stream. In the fourth, blood-culture was negative, and the temperature fell to normal ten days after admission, while from the fæces a paratyphoid organism (?) was obtained. The mildness of the disease in an inoculated man is now a well-established fact, and upon it depends the greater difficulty (here experienced) of obtaining the causal bacillus from the blood. One should therefore be on one's guard in such a case, to the extent of removing a larger quantity of blood, and of using more plates of the culture medium.

Referring now to blood-culture as a means of diagnosis of the

disease. The total number done in the period of five months was seventy-one, of which forty-two were positive. Taking the cases actually in the hospital which were eventually diagnosed as enteric fever, their total was forty-four, of whom thirty-nine were positive, a percentage of 88·6. This figure compares well with that obtained by Coleman and Buxton,[1] viz., 89 per cent. The cases in this series correspond pretty well with their group "first week."

Again, in thirty-two of the cases where I was able to make the blood-culture within a few days of admission, the average interval between the day of admission and the day the diagnosis was complete worked out at 3·3 days. The advantages of the method, both from the point of view of treatment and of prophylaxis, are evidently great.

The method used was that of Conradi, viz., the withdrawal, by means of a syringe, of 5 cc. of blood from a vein at the bend of the elbow, and its introduction into 10 cc. of the bile glycerine peptone mixture. After incubation about 1 cc. was spread on three plates, consisting of McConkey's neutral red bile salt lactose agar, and incubated. The first plate is always very thickly covered with growth, the second often contains individual colonies, while the third always does when a positive result is obtained. The diagnosis is considered complete if the colonies have the typical dewdrop appearance. They are then "fished" and examined at leisure.

Note by Lieutenant-Colonel W. B. Leishman.

This communication from Captain Smallman was accompanied by temperature charts of the whole of the thirty-six cases treated by antityphoid vaccine, but it was, naturally, impossible to reproduce them all in the pages of the Journal. Those which have been published were selected as being the ones to which most detailed reference was made in the text, and as serving to show the typical effects of the treatment upon the temperature curve, the output of urine, &c. They are neither the best nor the worst witnesses as to the beneficial effects of the vaccine.

It will, I think, be obvious from the report that this system of treatment shows considerable promise for good, and it is greatly to be hoped that it may be given a more extended trial. The virulence of epidemics of enteric being notoriously variable in

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[1] *American Journal of the Medical Sciences*, June, 1907.

different localities and at different times, it is most desirable that the treatment should be tested in other stations and by other hands.

The ordinary prophylactic vaccine may be used, provided its age does not exceed three months, and the dosage may readily be estimated by remembering that each first dose of prophylactic contains 500 million bacteria, and each second dose 1,000 million.

Major Horrocks has suggested that it would be advisable to treat every alternate case with the vaccine, so as to furnish the necessary control to the results, and this would certainly add to the value of any future reports upon the method. I need hardly add that we must await the results of estimations of the protective substances in those treated before being in a position to judge as to whether the theoretical basis of the method is well founded.

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THE ISOLATION OF *BACILLUS TYPHOSUS* FROM EXCRETA.

By Captain H. B. FAWCUS.
Royal Army Medical Corps.

The importance of having a rapid and easy method of recovering typhoid bacilli from excreta has become of great moment, since the existence of carrier cases has been clearly recognised, and the part they play in the spread of disease realised.

During the past two years I have been investigating the different methods at our disposal, in the hope of finding one that would be easy, rapid, and sure in its results. A short *résumé* of the most important methods in vogue, and the conclusions drawn from working with them, may be of assistance to others engaged in the same work.

The usual routine in examining stools for *B. typhosus* is to make a dilution of the stool, and spread part of this on some solid medium. It is in the composition of this solid medium that the various methods differ. The text-books on the subject give a large variety of processes without pointing to any one as being especially useful. The majority contain a sugar—generally lactose—and an indicator to distinguish those organisms which ferment the sugar from those which do not.

The media which have been in use for some time may be divided into two groups.

Group 1.—These media contain no inhibitory reagents, and thus allow all organisms in the stool to grow freely; a large surface is spread so as to obtain isolated colonies. The most important of these media are litmus lactose agar and litmus glucose agar, to which nutrose, which is supposed to favour the growth of *B. typhosus*, is sometimes added.

Group 2.—These media are designed with the object of preventing the growth of adventitious organisms, and thus giving the typhoid bacilli a better chance of showing themselves. Some of the media contain reagents which inhibit only the growth of saprophytic non-intestinal organisms, and have no effect on either coli or typhoid bacilli. The Conradi and Drigalski medium, Endo's medium, and bile salt lactose neutral red agar are well-known examples of this class. Phenolated gelatine need not be

considered, as it is never used now. Other media of this group attempt to go even further, and to inhibit the growth of *B. coli* without affecting *B. typhosus*. Of these we have media containing caffeine, as in Gaehtgens' modification of Endo's medium, and malachite green, as first introduced by Loeffler.

In examining stools from a case of enteric fever it is generally comparatively easy to isolate *B. typhosus* during the second or third week of the disease, when it is usually found in large numbers, being often the most numerous organism present. In such a case the media of Group 1 are sufficiently reliable for use, but a large surface of the medium must be stroked, and as there are several organisms which, growing on these media, give the typical transparent colony supposed to be distinctive of *B. typhosus*, a large amount of "fishing" of colonies is sometimes required before one arrives at the right one.

It is when the typhoid bacilli are less numerous in the stools that the advantage of the media in Group 2 should become apparent, but unfortunately experience shows that they are only a little superior to the others, and are likely to succeed only when the typhoid bacilli are slightly less numerous than in the first case. Bile salt lactose agar is to be preferred to Conradi and Drigalski's agar, as it limits the growth to purely intestinal organisms, and gives a much sharper differentiation of typhoid from coli colonies. The latter medium is troublesome to make, and the recognition of colonies on it is often difficult. On both these media coli organisms grow luxuriantly, and crowd out the typhoid bacilli, if at all sparse in numbers.

The remaining media of Group 2 are Endo's agar, containing caffeine, and Loeffler's agar, containing malachite green. These two substances have also been combined in one medium. They are supposed to inhibit the growth of *B. coli*, and not to affect the growth of *B. typhosus*. A long series of experiments with these reagents has forced me to the conclusion that they are quite useless for the detection of sparse typhoid bacilli in stools. The reason is, that while they undoubtedly have an inhibitory effect on *B. coli*, yet they inhibit just as much, if not more, the growth of *B. typhosus*. Thus, if a stool contain a few typhoid bacilli, these will be prevented from growing at all, long before the infinitely more numerous coli organisms are sufficiently inhibited to give the typhoid bacilli an opportunity to appear on the plate. Caffeine is certainly detrimental to the growth of *B. typhosus*, and inhibits it rather more than it does *B. coli*. Malachite green is a

little better, as it is more detrimental to some members of the coli group than it is to *B. typhosus*. Thus, whereas *B. coli* of Escherich and *B. acidi lactici* may be unable to grow on a malachite green medium, on which typhoid bacilli will grow, other members of the group, such as *B. lactis aerogenes* and other cane-sugar fermenters, grow in abundance, and overwhelm any typhoid bacilli that may be present. For similar reasons a combination of caffeine and malachite green is worse than useless. Malachite green also forms more or less of a precipitate when added to a medium containing peptone, a fact which may account for the varying results of different observers. Malachite green media contain no indicator to distinguish between the coli and typhoid colonies, and this is a great disadvantage, as without one it is well-nigh impossible to pick out a typhoid colony either by naked-eye or microscopic appearances.

Of all the above media I have obtained the best results with bile salt neutral red lactose agar and the original Endo medium without the caffeine, but even these media can be trusted to detect the typhoid bacilli only when they exist in large numbers in the stools.

Three recently-published methods may be mentioned more fully :—

(1) In November, 1907, Klein (*Lancet*, vol. ii., 1907, p. 1519) recommended that typhoid materials should be incubated in a fluid medium containing 0·06 per cent. bile salt and malachite green in a strength of 1 in 1,500 to 1 in 1,600. After twenty-four hours incubation portions of this were plated on Conradi and Drigalski medium, when almost pure cultures of *B. typhosus* were obtained. I have tried this method, and have found it successful only when, as stated above, the cane-sugar fermenters of the coli group are absent, and this is rarely the case with stools. I have also found that the amounts of typhoid bacilli Klein added to his experimental materials were easily demonstrable on solid media without preliminary incubation in this way.

(2) A method recently adopted by the French Army Medical Service, described by Braun (*Archives de Médecine et de Pharmacie Militaire*, September, 1908), is a modification of Endo's medium. It contains no caffeine, and is made as follows :—

A 4 per cent. nutrient agar is made neutral to litmus paper, and to every litre are added—

10 cc. of a 10 per cent. solution of soda,
10 grammes of lactose,
5 cc. of a 10 per cent. alcoholic solution of fuchsin,
25 cc. of a 10 per cent. solution of sulphite of soda.

The resulting medium is pale pink, *couleur marmelade de pomme*, which is then poured into large Drigalski plates 19 cm. in diameter. It is an easy medium to work with, and gives sharp differentiation between the typhoid and coli colonies, but, as many organisms grow well on it, the typhoid bacilli are apt to be overgrown, unless a large surface is spread with the material. Nevertheless I have found it give good results when fair numbers of typhoid bacilli are present in the stool.

(3) In July last Conradi (*Muenchener medizinische Wochenschrift*, July 21st, 1908) introduced a new medium, which marks a distinct advance on any hitherto devised. It is made as follows :—

To 900 cc. of water are added—
30 grammes of agar,
20 grammes of Liebig's extract,
100 cc. of a 10 per cent. solution of peptone (Witte).

The reaction of the agar is brought to +30 with normal phosphoric acid. Then to each $1\frac{1}{2}$ litre are added 10 c.c. of a 1 in 1,000 watery solution of brilliant green crystals (pure, Grubler, & Co. (Hochst)), and 10 c.c. of a 1 per cent. watery solution of picric acid. Immediately after mixing the clear green agar is poured into large shallow dishes. Conradi affirms that this medium prevents altogether the growth of *B. coli*, but has no inhibitory effect on *B. typhosus* or paratyphoid organisms, and by its use these can easily be isolated, even when present in small numbers.

In connection with this it is interesting to note the results of Kype-Burchardi (*Hygienische Rundschau*, November, 1908), who made quantitative estimations of various organisms when sown on this medium, as compared with the Conradi-Drigalski medium.

I.	Growth of	*B. typhosus*	stroked on	Conradi	medium,	70·1	per cent.	recovered.
II.	,,	,,	,,	Drigalski	,,	73·1	,,	,,
III.	,,	*B. coli*	,,	Conradi	,,	0·2	,,	,,
IV.	,,	,,	,,	Drigalski	,,	73·2	,,	,,

The estimates were done with pure cultures of the organisms.

I have tried this medium, and find that the brilliant green and picric acid undoubtedly have a marked inhibitory effect on coli organisms, though they by no means entirely prevent them from growing. At the same time they appear to have little, if any, inhibitory effect on *B. typhosus*. Other organisms, however, grow equally well on the medium, such as proteus, pyocyaneus, and fluorescens liquefaciens.

Of all the media hitherto devised, Conradi's is undoubtedly the

most useful and best suited for the isolation of *B. typhosus* from stools. On the other hand, it has the distinct disadvantage of being without an indicator to distinguish clearly between the various colonies which grow on it. Conradi affirms that the typhoid colonies can readily be distinguished by naked-eye and microscopic appearances, and that in this way they can even be distinguished from paratyphoid colonies. This may be possible to a finely practised eye, but to the ordinary observer typhoid, coli, proteus, &c., colonies appear to grow exactly alike, at any rate in the early stages, and one is reduced to the expedient of fishing every colony, until one finds one that is agglutinated by a typhoid serum. This entails the expenditure of much time which might be saved by the use of an indicator to distinguish the acid-forming colonies which are so numerous in fæces, and which crop up on every plate even of this medium.

Recognising the value of this discovery of Conradi, I have ventured to modify the medium both in composition and reaction. I have combined the brilliant green and picric acid with lactose and bile salt, the result being a medium which has the same inhibitory effect on rival organisms as Conradi's medium, and which at the same time shows up plainly the acid-forming colonies. The bile salt acts as the indicator by reason of its being precipitated by the acid formed from the lactose by organisms fermenting this substance, and it also assists the inhibitory action on non-intestinal bacteria. At the same time I found it necessary to increase the strength of brilliant green and picric acid owing to the "enrichment" effect of bile salt on coli organisms. The acid reaction of the medium I have also reduced to half that of Conradi's medium. It is not possible to have a reaction of + 30 without precipitating the bile salt. Such a high acidity as + 30 may be useful in inhibiting the growth of some organisms, and vigorous typhoid bacilli may grow well on it, but if they have become at all enfeebled, typhoid bacilli are extremely susceptible to an increased acidity, and I find that a less acid medium is more favourable to their growth.

The medium is made as follows:—

To 900 cc. of tap water add—

5	grammes	sodium taurocholate (commercial from ox bile).
30	,,	agar (powder).
20	,,	peptone (Witte).
5	,,	common salt.

Dissolve in steamer for three hours. Clear with white of egg,

filter through wadding, and bring to a reaction of + 15 with normal lactic acid or normal soda, as required. Dissolve 10 grammes of lactose in 100 cc. of distilled water, and add to the melted agar. Mix well, and filter through Chardin paper. To each 100 cc. of the clear bile salt lactose agar add 2 cc. of a 1 in 1,000 watery solution of brilliant green (extra pure, G. Grubler & Co.) and 2 cc. of a 1 per cent. watery solution of picric acid. Thus the finished agar contains bile salt 0·5 per cent.; brilliant green, 1-50,000; and picric acid, 1-5,000. The resulting clear bright green agar is poured without further heating into large Drigalski plates of 17-20 cm. in diameter. After solidification the plates upside down are placed to dry in the incubator, with the covers off, the edge of the dish resting on the edge of the cover, and left for two or three hours, when they are ready for use. If preferred, the covers may be left off altogether until the agar has solidified, without fear of contamination, as no ordinary air organisms will grow on them; the drying process can be done much more quickly in this way.

The medium should not be kept in flasks ready made, as it deteriorates, and re-melting the agar to pour fresh plates disintegrates the brilliant green. It is convenient to make the bile salt lactose agar in bulk, and distribute it into flasks, each containing 150 cc. When required for use, one of these is melted, and 3 cc. of each of the solutions of the dyes added and well mixed. This amount is sufficient to make three of the largest plates.

The plates are then inoculated with the material to be examined. A portion of the stool is made into an emulsion with sterile normal salt solution in a test-tube, and left standing for fifteen minutes or so. The amount of dilution depends on the consistency of the original stool. If it is very fluid, it may be used without dilution. A large loopful from the surface of the emulsion or fluid stool is placed in the centre of one of the plates, and with a glass spreader is gently but thoroughly rubbed over the whole surface of the agar. The plates are then incubated at 37° C., upside down. In cases where the number of typhoid bacilli, if present, is expected to be small, as in the case of carriers, several plates should be made from the same stool, using a fresh loopful of the material to each plate, though as a rule in favourable cases it will be found that one plate is ample to demonstrate their presence.

After twenty-four hours' incubation the typhoid colonies have attained a diameter of about 1 mm. They are round, quite transparent, and highly refracting. Where the medium is thick they

appear by transmitted light to be pale green; where it is thin they are as clear as drops of water. At this stage the colonies of the coli group have a dark green opaque spot in the centre, although the edges may be transparent. If they are strong acid-formers, the colony is surrounded by a haze in the medium, due to precipitated bile salt. Very few of these strong acid-formers appear to grow on this medium, or it may be that their acid-forming properties are inhibited. Other organisms of the coli group do not form enough acid to cause a haze round the colony, but they still form enough to render the colony opaque, and give it a dark green centre, and they are thus easily distinguished from the transparent typhoid colonies. Another type of colony which is usually present is one which appears as a thick opaque white growth without any green centre, but it is not likely to lead to confusion.

After forty-eight hours the typhoid colonies are still more easily distinguished from those of other bacilli, and it is best to wait until this period before judging a plate. They have now attained a diameter of about 2 mm. They are circular, but sometimes have an irregular margin. They are still quite transparent, without a trace of opacity in their structure, but now they have a somewhat green centre, very slightly darker than the surrounding medium. This appearance is really due to the medium at the periphery of the colony becoming a rather yellower shade, and not to any darkening of the colony itself, which still remains transparent.

At this period a coli colony, in fact almost every other colony on the plate, has an opaque dark green centre easily distinguishable from the transparent green of the typhoid colony, and the growth is thick and opaque, though the edge may be transparent. At this stage some very small transparent colonies may be seen, in appearance like a typhoid colony after twenty-four hours' incubation. These consist of *B. coli* and such bacilli which have been inhibited in their growth, and are now commencing to appear. They are distinguished by their small size, and before they have reached the size of a typhoid colony they will have obtained an opaque green centre like the others of their type.

Paratyphoid colonies, colonies of the food-poisoning group, and dysentery bacilli are indistinguishable in their growth from those of *B. typhosus*.

This description of the appearance of the colonies only applies to those that are discrete and have a clear space of medium around them, and not to those which occur in a mass of colonies closely huddled together. It is never possible to judge of the nature of

colonies in a crowded plate, as their growth becomes stunted, and they may show an entirely different appearance from that which they present when they have sufficient space to grow out. After seventy-two hours the appearances of the colonies are much the same as after forty-eight hours, but the plate may have become somewhat fogged by the acid-forming colonies. Later than this it becomes difficult to pick out colonies of *B. typhosus* with any certainty.

After forty-eight hours' growth on the plate typical colonies are fished, and tested in a hanging drop for agglutination with a typhoid serum. Those which react to the serum are sub-cultured into the usual media for the determination of their morphological and cultural characters, and their specific reactions are thoroughly worked out.

PROTRACTED INFECTION IN ENTERIC FEVER, WITH NOTES ON A SERIES OF CASES APPARENTLY CAUSED BY A "CARRIER."

By Major E. W. W. COCHRANE.

Royal Army Medical Corps.

The difficulties in the way of accounting satisfactorily for the occurrence of many cases of enterica are well known, and the more recent work of Koch, Klinger, Kayser, Davies, Hall, and a number of other observers, has drawn attention to the influence of direct infection from one patient to another as one of the chief means of maintaining both the endemic and epidemic prevalence of this disease. An increasing number of circumstances emphasise the fact that enteric infection may, in fact does, exist in a latent form among presumably healthy persons, and that the number of notified or recognised cases is no measure of the amount of enterica among the members of a given community. As endorsing this view, our experiences at Aldershot during the present year are not devoid of interest.

During the first three weeks of September, 1908, four cases of enteric fever were admitted to hospital at Aldershot, all of which came from the same regiment—1st Battalion East Kent Regiment (Buffs)—which is quartered in Badajos barracks. These barracks are situated in Wellington Lines and are constructed on a rather out-of-date plan, as they are amongst the first permanent barracks built at Aldershot. They consist of two three-storeyed blocks in which there is accommodation for over 1,000 men. The blocks face one another about thirty yards apart and the intervening space used to be covered by a glass roof, which was removed at the beginning of this year. The rooms on the ground floor are chiefly used for regimental institutes, dining-halls and store-rooms, only a few being occupied as barrack-rooms. The first floor in the northern block is occupied by C and D Companies, 1st Buffs, which form a double company, having a common dining-room on the ground floor in No. 32 room. The rooms occupied by these companies are numbered from 38 to 46, the former being used as a company store; they accommodate twenty-four men each, except No. 46 room, which is at the eastern end, and owing to the ablution room being situated at the entrance, has only accommodation for nineteen men.

Early in September, two men were admitted to the Cambridge Hospital, and were subsequently found to be suffering from enteric fever. The first man (Private H.) was admitted on September 3rd,

1908; he belonged to D Company and had occupied No. 44 room. On investigation of his previous movements it was found that he had been on furlough at Shorncliffe from August 20th, 1908, to August 29th, 1908. The second case (Private C., of C Company) was admitted on September 4th, 1908. He had been on furlough at Ashford from August 11th, 1908, up to the date of admission to hospital. He was taken ill whilst at Ashford and returned to Aldershot before the expiration of his furlough, going direct from the station to the Cambridge Hospital without returning to barracks. Before leaving Aldershot he had lived in No. 40 room. The third case (Private B., D Company) was admitted on September 15th, 1908, to the Connaught Hospital. He, also, returned sick off furlough, having been at Ramsgate since August 11th, 1908, and, instead of coming on to Aldershot Town, got out at the North Camp Station and proceeded to the Connaught Hospital, where he was admitted. Before going on furlough he had occupied No. 45 room. The fourth case (Private G., C Company) was admitted to the Cambridge Hospital on September 17th, 1908. He had been on furlough at Sittingbourne from August 29th, 1908, to September 9th, 1908.

On making an inspection of Badajos barracks and its surroundings, nothing could be found to suggest a source of infection. The water supply is derived from the Aldershot Water Company which supplies the town of Aldershot and many other barracks in the camp. There had been no cases of enteric in the town for many months. The milk used by this regiment comes from the Deepcut Dairy, which supplies many other regiments. It is received twice daily in barracks and is taken at once to the cook-house, where it is used for tea. No milk is kept in the kitchens or store-rooms, and if a further supply is required for puddings, &c., it is sent for when needed and is used at once. The coffee-shop is kept clean, and condensed milk is used for making tea, no fresh milk being supplied. The R.A.T.A. room is also satisfactory, its milk supply being derived from the Deepcut Dairy. The possibility of infection through either milk or water in barracks appeared to be remote, as if either had been infected a much larger incidence of cases would be expected. The latrines and urinals are placed in a single block about ten yards to the north of the northern barrack block. They were reconstructed early this year and now consist of separate pedestal closets and glazed earthenware urinals; both are kept clean and free from smell. Night urine tubs are still in use; one being placed in the verandah outside each room at "retreat," but occasionally one tub is used by the men from two rooms. The

duty of carrying down and emptying the tubs at "réveille" devolves on the "orderly man" of each room. The same system for disposal of night urine still prevails in nearly every barrack in Aldershot. The general sanitary condition of the barracks was satisfactory, and no previous cases of enteric had occurred in them since February, 1908. Consequently, on consideration of the fact that each man had been on furlough during the incubation period—Private B. having been out of barracks over a month, Private C. over three weeks, and the other two men having been away at the likely date of infection—it was thought that these four men had most probably not contracted the disease in Aldershot. The events which followed shortly afterwards tend to show that this conclusion was incorrect.

The 3rd Battalion Rifle Brigade, at present stationed at Bordon Camp, sent 123 N.C.O.'s and men into Aldershot on October 10th, 1908, to go through a course of musketry, as the range at Bordon is closed. This detachment was quartered in Badajos barracks, and five barrack-rooms were handed over to them by the 1st Buffs; two of these, viz., Nos. 43 and 46, being on the same landing as C and D Companies, 1st Buffs, and having been previously occupied by men of these companies. A separate cook-house was given to the Rifle Brigade detachment. The musketry being finished, the detachment marched back to Bordon on November 3rd, 1908, but one man (Private B.) went sick that morning and was admitted to the Cambridge Hospital. On the following day a second man man (Private D.) was sent into hospital from Bordon. Both these men had been in No. 46 room, Badajos, whilst in Aldershot. On November 8th, 1908, I was asked to see the latter man at the Cambridge Hospital and to examine his blood by the culture method, to endeavour to recover the *Bacillus typhosus* and verify the diagnosis of enteric fever, as his symptoms pointed to this disease. Ten cc. of Conradi's glycerine ox-bile peptone medium were inoculated with 1 cc. of the patient's blood taken aseptically from the median basilic vein in a sterilised hypodermic syringe. After incubation a motile bacillus was grown, which subsequently gave the characteristic reactions of the *B. typhosus*. A similar culture was made in Private B.'s case on November 11th, 1908, with a like result. On this latter date, a third man (Private O.) arrived sick from Bordon, and on November 12th, 1908, a fourth (Private P.) was admitted to the Cambridge Hospital suffering from symptoms which suggested enteric fever; both men whilst in Aldershot had also occupied No. 46 room, Badajos. Enteric bacilli were recovered from the blood in both cases from cultures made on

November 13th, 1908. Besides these four men, two others belonging to the 1st Buffs were admitted to the Cambridge Hospital about this time and were subsequently diagnosed enteric. Private A., of C Company, reported sick on November 4th, 1908; he came from No. 42 room. The attempt to recover the *B. typhosus* from his blood made on November 14th, 1908, proved unsuccessful, but later his serum gave a positive Widal's reaction. The other man was Private S., E Company, who was admitted on November 7th, 1908, from No. 23 room, which is situated on the first floor of the southern block. The *B. typhosus* was recovered from his blood on November 11th, 1908.

Four cases of enteric fever having now occurred among the men of the Rifle Brigade detachment who had been in No. 46 room, and two other cases from the Buffs being in hospital, there was little doubt that there must be some local source of infection in the barracks, and five out of the six having come from rooms occupied by C and D Companies of the Buffs where previous cases had arisen, it was thought that the infecting focus was probably in these companies.

The food supplies of the Buffs and the Rifle Brigade whilst in Badajos were quite distinct, as the latter had a separate cook-house and took their meals in their barrack-rooms, whereas the former used a dining-room on the ground floor. The regimental institutes, &c., were common to both, but, excepting Private S., cases had not occurred amongst the other companies of the regiment, nor among the men of the Rifle Brigade who had occupied other rooms.

Infection through bedding was not probable, as clean bedding had been issued from the barrack-store to the Rifle Brigade on arrival in Aldershot. The nature of the outbreak suggested that there was a "carrier" among the men of C and D Companies who had originally infected the four men belonging to these companies in August, and had subsequently given the disease to the men of the Rifle Brigade and the two others of his own regiment.

It was therefore decided to parade C and D Companies, with a view to finding the men who had previously suffered from enteric, and this was done on November 11th, 1908. Every man was inspected and questioned as to whether he had had the disease, and out of the two companies nine men were found who had recovered from enteric, and returned to duty on dates varying from 1895 to 1907. The statements made by these men were verified by inspection of the medical history sheets of the two companies, and no other entry of this disease was found on the sheets of the other men. The following day (November 12th, 1908) these nine

men attended at the School of Sanitation, and each was fully questioned as to whether he had any symptoms suggestive of gall-bladder infection; enquiries were also made as to the condition of their urine, but nothing of importance was discovered. The men were then made to pass urine, and the last ½ ounce from each was collected in a sterile test-tube. At the same time specimens of blood were taken in capsules from each man, as it was thought that the serum of a man still infected by the *B. typhosus* would sediment and agglutinate at higher dilutions than that of one who had definitely overcome the infection some time previously. The results obtained did not bear out this theory, as the only man whose serum did not sediment completely in a dilution of 1 in 100 in twenty-four hours was Corporal I., of D Company, who will be mentioned again later.

One cc. of each of the urine samples was put in a test-tube containing 10 cc. of Conradi's ox-bile medium, and was incubated at 37° C. for twenty-four hours.

The following day neutral-red glucose agar plates were stroked from each tube and put in the incubator for twenty-four hours, and the plates numbered from 1 to 9. On November 14th, 1908, the plates were examined: Nos. 5 and 7 had no growth on them, and were again inoculated from the ox-bile tubes after forty-eight hours incubation, but still gave no growth; Nos. 3, 4, 6 and 9 gave growths which, on examination, proved to consist entirely of cocci; the growth on No. 8 plate was a short bacillus which, on further investigation, proved to be non-motile. No. 1 plate gave a growth of cocci and bacilli; the latter were non-Gram staining, but were also non-motile. On No. 2 plate there was an apparently pure culture of a non-Gram staining bacillus showing short forms and filaments, which at first was only feebly motile. The No. 2 bacillus was now planted out on different media, and the following results were obtained:—

On Gelatine.—No liquefaction; growth was very slow and restricted, owing to the lack of a 22° C. incubator.

Mannite Litmus Broth.—Acid formed no gas.

Glucose Litmus Broth.—Acid formed no gas.

Neutral-red Glucose Agar.—No fluorescence.

Peptone Broth.—No formation of indol in six days.

Milk.—No clotting in six days.

Litmus Milk.—No acid formed; no clotting.

An agar slope of the No. 2 bacillus, together with growths of the bacilli recovered from the blood of Privates D., S., and B., were sent to the Royal Army Medical College, Millbank, for examination.

A report received from Major Grattan, R.A.M.C., on November 28th, 1908, stated that all four cultures gave similar reactions, and were apparently identical, and his results were the same as those given above, except that all four produced slight acid with lactose.

The next step was to test the bacillus with an antityphoid serum. An emulsion was made from a twenty-four hours growth on agar, and at the same time a similar emulsion was made of the stock *B. typhosus*. These emulsions were tested by Widal's reaction with serum from Private C. (one of the first cases mentioned above). Both the No. 2 bacillus and the *B. typhosus* agglutinated in a dilution of 1 in 30 serum in half an hour, as seen both macroscopically and microscopically; both sedimented in dilutions up to 1 in 200 serum in capillary tubes in twenty-four hours.

A second experiment was tried on November 22nd, 1908, with serum from Private A., whose symptoms pointed to enteric, but from whose blood the *B. typhosus* had not been recovered on November 14th, 1908, and with serum from an animal immunised against the *B. typhosus* which had been received from the Royal Army Medical College, Millbank. The results were as follows :—

One part Cl. serum 1 in 15, diluted with normal saline solution + 1 part B.T. emulsion, gave some clumping, but not a complete reaction in half an hour.

One part Cl. serum 1 in 15 + 1 part No. 2 bacillus emulsion gave a complete reaction in the same time.

One part A.T. serum 1 in 15 + 1 part B.T. emulsion gave fairly good clumping in the same time.

One part A.T. serum 1 in 15 + 1 part No. 2 emulsion gave good clumping under the same conditions.

From the above results, it was nearly certain that the No. 2 bacillus was a true *B. typhosus*. The urine from which it had been recovered had been passed by Corporal I., of D Company, 1st Buffs. He had suffered from enteric fever at D'thalla, Aden Hinterland, in 1904, having been in hospital from July 12th, 1904, to November 10th, 1904.

He was sent for on November 17th, 1908, and the following information was obtained: On discharge from hospital in November, 1904, he came home from Aden with his battalion and went to Dover. He was given furlough from December 15th, 1904, to March 14th, 1905, when he went to Maidstone and stayed with his relations. None of the members of his family were ill either during or after his visit. He was at Bulford from June 4th, 1905, to October 3rd, 1905, with 24th Company Mounted Infantry; at Shorncliffe from December 1st, 1905, to December 15th, 1905;

at Longmoor from January 1st, 1906, to March 31st, 1906, with Mounted Infantry; at Shorncliffe, attached to the Royal Scots, from October 1st, 1906, to December 2nd, 1906; at Longmoor again from April 1st, 1907, to July 3rd, 1907. Two men belonging to the Buffs, who were in the same Company at Longmoor during this latter period, contracted enteric, and during the time he was at Dover, three men of D Company also suffered from the disease. Since his arrival at Aldershot on October 1st, 1907, he has been in the same barrack-room, viz., No. 45. Six cases of enteric fever were admitted from Badajos during the first six months they were occupied by the 1st Buffs. Three of these were men of the regiment from H, C, and B Companies, and the other three were among the Royal Army Medical Corps Militia, who had rooms in this barrack at that time.

On making enquiries in Badajos, it was found that one urine tub served for both Nos. 45 and 46 rooms, and that this arrangement had been in force when the latter room was occupied by the detachment of the Rifle Brigade. It was consequently imagined that the men of the Rifle Brigade might have been directly infected by handling this tub, as Corporal I. stated that he had invariably used it at night, and never made use of those outside other rooms, but on questioning them, only one man, Private O., admitted having carried it down when "orderly man." Further enquiries did not throw light on the method by which these men had become infected, but the fact that this Corporal is passing typhoid bacilli in his urine, and that several cases of the disease have occurred in his immediate vicinity, at least suggest that he is the primary source of infection, and, consequently, steps were taken for his isolation and treatment. He was given urotropine in 10-grain doses twice daily, commencing on November 17th, 1908, and it was arranged with the regimental authorities that he should be segregated in a small room in a different building from the barrack-rooms. He was supplied with cresol to disinfect any urine passed during the night, and he was warned as to the danger to others arising from neglect to use a recognised urinal. On this date his urine was again examined by the same method as on the first occasion, and a similar bacillus was recovered. The urine was somewhat cloudy in appearance when passed, had a specific gravity of 1019, contained a trace of albumen, was faintly acid in reaction, and numerous pus cells were found by microscopic examination of the sediment.

A third bacteriological examination of his urine was made on

November 30th, 1908, and a bacillus recovered which gave the same reactions as those previously isolated.

At the last examination, made on December 6th, 1908, a mixture of cocci and bacilli was grown; the latter do not appear to be typhoid bacilli, and their identification is at present under investigation. If it is found that the bacilluria persists in spite of administration of urotropine, local treatment of his bladder will be commenced.

The question has arisen as to whether this man should be permitted to serve, or should be invalided. In my opinion, the latter course is not advisable, as not only would this man be a great source of danger to the community at large, if sent into civil life where he could not be kept under such close observation as at present, but it is our duty to endeavour to render him free from infection before allowing him to leave the Army.

In case the administration of urotopine and local bladder treatment do not arrest the excretion of the bacilli, it is probable that either the kidney or the gall-bladder is the focus of infection, and in the latter event, it is difficult to see how the case is to be treated. There is no doubt that he should be kept under observation for at least a couple of years, even if the bacilluria is controlled by treatment, when one remembers the time which has elapsed since the acute stage of the disease.

In recording this case, it is not claimed that proof has been given of the direct relationship of the carrier to the incidence of the disease; but that there is some connection is, at least, suggestive, when one considers the numbers of cases of enteric fever which have occurred in the Aldershot Command during the last three years. In 1906 there was a total of eleven cases; in 1907 there were sixteen cases, six of which originated amongst the Guards at Pirbright camp, and three came from Badajos barracks after the arrival of the 1st Buffs; in 1908, twenty-eight cases have been recorded, and thirteen of these have had their origin in Badajos. It appears probable that whatever barracks this regiment had occupied, cases of the disease would have arisen, for before their arrival in the Command there had been several men infected. The practical difficulty in dealing with a unit in which a series of cases has occurred is the discovery of a carrier of infection, and even if one is found, there is always the possibility of the existence of more than one. In the present instance, little difficulty was experienced once the examination of the men who had suffered from the disease was commenced, but on other occasions one might make prolonged investigations without practical results.

STATISTICAL TABLE OF THE RECENT RESULTS OF ANTITYPHOID INOCULATION.

By Brevet-Lieutenant-Colonel W. B. LEISHMAN.

Royal Army Medical Corps.

At the end of 1904, soon after the re-introduction of Sir A. E. Wright's system of inoculation, certain further steps were advocated by the Committee which had been appointed by the Army Council to consider the whole subject, and of which I have the honour to be a member. One part of their recommendations consisted in the advocacy of certain experimental investigations with a view to possible improvements in the vaccine, and the results of much of this work have already appeared, in the columns of the Journal of the Royal Army Medical Corps, in a series of reports by my colleagues and myself. Another part was concerned with the collection of accurate statistical information as to the results of inoculation.

The final report of the Committee, together with the full experimental and statistical results, will appear before long, and I have no authority to anticipate its judgments and recommendations. In view, however, of the happily increased interest which is being taken in the subject, and to meet a wish which has been frequently expressed for more recent figures as to the results of inoculation, I am permitted by the Director-General to reproduce here a statistical table which was recently presented by me for the consideration of the Committee.

A few words are necessary to explain its nature. It was advocated by the Committee that each unit of the army leaving this country for foreign service should have a junior medical officer attached to it, for a period of three years, whose duty it should be to carry out the antityphoid inoculations, to verify the diagnosis of enteric by modern scientific means and to collect accurate statistical information as to the protective effects of the vaccine. Their recommendations on this matter were acted on by the authorities and, from the beginning of the year 1905 till the present day, twenty-four units of the various arms of the Service, which have left this country for foreign service, have had special medical officers attached to them for the above purpose. Each of these officers had a preliminary course of instruction at the Royal

Army Medical College before joining the unit to which he was attached. The duty of co-ordinating their work devolved upon the writer, and he has been in constant correspondence with these officers upon matters concerning their special duties. The accompanying table gives a summary of the results of inoculation in the first sixteen of these units, compiled from the latest information which reached me up to June 1st, 1908. The remainder of the units, having left this country subsequent to the termination of the trooping season, 1907-8, are not included in the return.

A similar return will be appended to the final report of the Committee and will include more recent information and a detailed account of the inoculation history of each unit, as well as the report of a sub-committee appointed to consider the case sheets and temperature charts of the whole of the cases of enteric fever occurring in the units. This will, doubtless, be accompanied by an expression of the views of the Committee upon the conclusions to be drawn from the figures. In the meantime, it will suffice to append a short commentary upon some points which appear to call for explanation.

In order to give full value to the results disclosed in the table it should be borne in mind that every precaution has been taken in all the cases of enteric fever to verify the diagnosis and that, in a large proportion of them, Eberth's bacillus was isolated from the blood or the stools during life.

The various columns of the table, are, I think, self-explanatory and the only points needing comment are the following. The column of the total strength of the unit refers to the *actual* strength, excluding officers, women, and children, present with the unit on the day upon which the last report was forwarded to me by the medical officer in charge. The number of cases and deaths from enteric, among the two groups of inoculated and non-inoculated, includes the *total* number which have occurred in the unit during the time it had been under the observation of the medical officer.

Turning to the table, it will be seen that the totals of the two groups of inoculated and non-inoculated are fairly homogeneous, 5,473 men in the former case and 6,610 in the latter, but it will also be noted that, in five of the units, no cases of enteric have occurred in either group. The totals of these units, therefore, swell the general totals without affording any evidence on the value of inoculation, and I have accordingly estimated the case-incidence per 1,000 of a second grouping of what may be called the "exposed

units," *i.e.*, those in which cases of enteric had shown that the unit had been exposed to infection.

Yet a third series of case-incidence figures is also appended for the following reason. The first unit inoculated, namely, the 2nd Royal Fusiliers, was the Battalion at Aldershot which furnished the material for the analytical work on the blood-changes following inoculation, in the end of 1904.[1] In the case of this unit the vaccine used was prepared in the manner customary in the earlier days of inoculation and was subjected in the process to the action of a temperature which we have since found to have a deleterious effect upon its immunising properties, namely, 62° C. It was by no means inert, as the results of the analytical work in question abundantly testify, but it appears to us, in the light of more recent experiment and experience, that the immunity conferred by such a vaccine could not be expected to last for any length of time. This view is borne out by the statistical results in the case of this unit which show little or no protection among those inoculated when enteric fever attacked the Regiment about a year after inoculation. The vaccine used in this case may be spoken of as the "old vaccine," to distinguish it from the "new vaccine," in which the heating has never been carried above 53° C. At the same time, it should be emphasised that this "new vaccine" differs only in respect of certain technical details of preparation from that which we owe to Sir A. E. Wright.

The third table of case-incidence, then, has reference only to those units in which the majority, if not the whole of the inoculated had received "new vaccine," and which had, further, been exposed to infection. This last series, therefore, furnishes the best evidence as to the protective effects of the vaccine which is in use at the present day.

A few notes are appended to the table giving some particulars in connection with the twenty-one cases which were reported among the inoculated.

Further comment may, I think, be dispensed with in view of the eloquence inherent in the figures themselves.

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[1] W. B. Leishman, Journal of the Royal Army Medical Corps, vol. v., p. 1, 1905.

STATISTICAL TABLE, SHOWING THE RESULTS OF ANTITYPHOID INOCULATION IN SIXTEEN UNITS OF THE ARMY, UP TO JUNE 1, 1908.

Unit	Medical Officer	Station	Date of arrival	Total strength (actual)	Inoculated			Non-inoculated		
					Number	Cases	Deaths	Number	Cases	Deaths
2nd Roy. Fus.	Capt. A. B. Smallman	Trimulgherry	Jan., 1905	1,013	198	10	1	815	59	9
17th Lancers	,, E. J. Luxmore	Meerut ..	Oct., ,,	616	322	3	0	294	71	12
Brigade, R.A.	,, E. G. Lithgow	Pindi(from Transvaal)	Nov., ,,	370	60	0	0	310	7	0
14th Hussars	Lieut. C. E. Fawcett	Bangalore	Oct., 1906	647	386	2	0	261	4	1
2nd Dorsets ..	,, E. G. Anthonisz	Wellington	Nov., ,,	1,107	199	1	0	908	6	0
3rd Coldstream Guards	,, J. H. Graham	Cairo ..	Oct., ,,	705	569	1	0	136	13	1
2nd Leicesters	,, H. S. Sherren	Belgaum..	,, ,,	963	346	3	1	617	17	1
1st Connaught Rangers	,, A. D. O'Carrol	Dagshai (from Malta)	Mar., 1907	483	300	0	0	183	2	1
3rd Worcesters	,, W. H. Forsyth	Wynberg..	Dec., ,,	900	220	0	0	680	3	0
1st Dragoon Guards	,, G. H. Stevenson	Umballa ..	,, ,,	592	450	0	0	142	0	0
1st Yorks ..	,, S.deC.O'Grady	Cairo ..	Jan., 1908	893	470	0	0	423	0	0
1st Suffolks ..	,, J. B. G. Mulligan	Malta ..	Dec., 1907	900	400	0	0	500	0	0
3rd Roy. Rifles	,, R.W. D. Leslie	Crete ..	Feb., 1908	879	190	0	0	689	0	0
2nd Bedfords	,, C. M. Drew ..	Gibraltar	Sept., 1907	700	320	0	0	380	3	1
Brigade, R.A.	,, A. S. Littlejohns	Pretoria ..	Nov., 1907	375	247	1	0	128	2	0
1st Lan. Fus.	,, F.D.G. Howell	Chakrata	Dec., ,,	940	796	0	0	144	0	0
			Totals	12,083	5,473	21	2	6,610	187	26

CASE-INCIDENCE PER 1,000.

	Inoculated	Non-inoculated
(1) Among the whole of the above sixteen units ..	3·8	28·3
(2) Among the "exposed" units, *i.e.*, in which cases of enteric had occurred	6·6	39·5
(3) "Exposed" units, *less* Royal Fusiliers (the unit inoculated with the "old vaccine")	3·7	32·8

NOTES ON THE CASES OF ENTERIC OCCURRING AMONG THE INOCULATED MEN OF THE SIXTEEN UNITS.

Unit	Cases	Deaths	Remarks
2nd Royal Fusiliers	10	1	All of these cases had been inoculated with the old vaccine; no case occurred among the men subsequently inoculated with the new vaccine.
17th Lancers	3	0	New vaccine in all, but each of these men had refused their second dose.

Unit	Cases	Deaths	Remarks
14th Hussars	2	0	Each had two doses of the new vaccine. Both cases were extremely mild; in one the fever only lasted eight days, in the other the maximum temperature was 101° F.
2nd Dorsetshire	1	0	Received one dose only of new vaccine; reported as "exceedingly mild."
3rd Coldstreams	1	0	Twice inoculated with new vaccine; ran a normal course.
2nd Leicesters	3	1	All inoculated with the old vaccine. Of the two which recovered, one was very mild, the other fairly mild. The fatal case only received his second dose one month after the first.
13th Brigade, R.H.A.	1	0	Twice inoculated with new vaccine. Diagnosis very doubtful, only six days fever in hospital, blood culture negative, serum reacted to paratyphoid "B."

Summary.—There are only *four* cases among the above *twenty-one* which had received two doses of the new vaccine; all recovered. Three of the four had been noted as extremely mild, and the diagnosis of enteric in one of these is doubtful.

Editorial.

PREVENTION AND TREATMENT OF ENTERIC FEVER.

At the present day the "typhoid carrier" is regarded as an important agent in the propagation of enteric fever, and we publish in this number a very interesting series of cases investigated by Major Cochrane. In this outbreak it seems probable that the infecting agent was a carrier excreting the *Bacillus typhosus* in the urine. More commonly, however, the excretion of the specific bacillus appears to be in the stools, and the most recent bacteriological investigations have shown that about 4 per cent. of convalescent enteric cases become chronic carriers. Now it is very important to note that these carriers excrete the bacillus in an intermittent manner, and very considerable doubt still exists as to how long the excretion persists. Kayser collected 101 cured cases of enteric fever which had been declared typhoid-free, and yet two years after convalescence three were still found harbouring the bacillus. The uncertainty as to the duration of the excretion of the bacillus and its marked intermittency, coupled with the well-known difficulty of isolating the *B. typhosus* from a mixture of fæcal organisms, militate against the inception of a practicable scheme for dealing with the chronic carrier. It is true that the bacteriological work has been greatly simplified by the labours of MacConkey, Conradi and Drigalski, and other investigators. The latest medium suggested by Conradi constitutes a great advance in the methods at our disposal. This medium, which contains brilliant green and picric acid, has been modified by Captain Fawcus (see p. 147), and by the addition of an indicator the recognition of typhoid colonies has now become a comparatively simple matter. The administrative difficulties, however, still remain. Must we isolate all our typhoid convalescent cases, and, if so, for what period? Can we ever be sure that the fæces of a typhoid convalescent are free from typhoid bacilli? Up to the present a practicable method of treating the chronic carrier has not been devised, and some bacteriologists believe that "once a carrier, always a carrier."

In France, the question of the bacillus carrier has been carefully studied, and it is now ordered: (1) That typhoid fever cases shall be kept in hospital until a bacteriological examination of the stools

and urine has shown that the *B. typhosus* is absent from these excreta; and (2) that every soldier returning to his corps from leave after convalescence from enteric fever shall be carefully examined with the object of ascertaining if he is still a carrier. In small stations, where the cases of enteric fever are few in number, it might be possible to carry out these orders, but in countries like India the administrative difficulties would be very great, quite independently of the possible existence of a native carrier, an important question which has not yet received sufficient consideration. The problem, however, is now being faced, and we shall watch with keen interest the results of the present policy. Without in any way wishing to minimise the importance of the results obtained by the sanitary measures now in vogue, we cannot help thinking that the most practical preventive measure in our hands at the present time is antityphoid inoculation. The influence of this measure must be apparent to all who carefully study the figures published by Lieutenant-Colonel Leishman in this number of the Journal. Antityphoid inoculation alone cannot stamp out enteric fever in a tropical country like India, but we firmly believe that it will so diminish the number of cases as to render administrative measures dealing with the "carrier" practicable.

As regards the treatment of enteric fever, we wish to call attention to the paper by Captain Smallman (see p. 136) dealing with the treatment of this disease by means of injections of antityphoid vaccine. After hearing Chantemesse's paper on the treatment of enteric fever by injections of antityphoid serum, the idea occurred to Colonel Leishman that injections of antityphoid vaccine would probably give similar results. The labours of Leishman and his colleagues having already shown that injections of vaccine produce protective substances in the inoculated person, there was every reason to hope for successful results. The only danger that could be foreseen was the possible production of a negative phase. Happily this has not been the case, and the amelioration of the patient's condition after each injection leads us to hope that an extended trial of the method, with suitable controls, will confirm the results already obtained.

A SIMPLE METHOD OF PREPARING LANTERN SLIDES.

THE following method, well known to physiologists, has been brought to our notice and should be of great service to sanitary officers.

A piece of glass, thoroughly cleaned, preferably by acid, is placed over the required diagram, which is then copied on the glass by means of process ink, and a crow-quill or etching pen. Indian ink may be used when process ink cannot be obtained. The ink is allowed to dry and any mistakes can then be rectified by simply removing the ink with the point of a penknife and re-drawing the part on the dry glass. A damp cloth should not be used to remove the ink in order to correct a diagram, for the moisture would make the ink run. If the slide is to be carried about it should be protected by another piece of glass of the same size placed over the drawing, the two slides being fastened together by a strip of binding material placed along the top and bottom. In making the diagram sufficient space must be left around the drawing to allow of the side being placed in the lantern without obscuring any of the detail.

With very little artistic skill any apparatus can be drawn on the glass and tables of figures can be reproduced with the greatest ease.

The great advantage of this form of slide is that it can be used in the lantern without darkening the room; the lecturer is thus able to see his audience when describing the details on the screen.

If the diagram on a slide is no longer required, the binders can be removed and the ink washed off with a wet cloth. When the slide is quite dry it can be used again, the same procedure being followed.

A slide can also be made by drawing on the glass blackened by the flame from a lamp containing turpentine. The detail should then be fixed by immersing the slide in varnish made by adding 10 cc. of castor oil and 250 cc. of pure hard white varnish to 1,000 cc. of methylated spirit.

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United Services Medical Society.

RECENT RESEARCH WORK ON THE USE AND ABUSE OF ALCOHOL.

By Fleet-Surgeon O. W. ANDREWS.

Royal Navy.

The subject of this paper is the use and abuse of alcohol, with special reference to recent research work which has not appeared in the text-books and treatises on the subject. I have tried to treat the question impartially, but it is an exceedingly difficult one; in fact, one over which discussions are apt to become as heated as over questions of religious dogma. The otherwise level-headed often become quite unreasonable when the subject under discussion is alcohol, and many well-meaning advocates of total abstinence (which is quite different from temperance) have done much injury to their cause by attempting to prove too much, which, as everyone knows, ends by proving nothing. Alcoholism is no new thing; the very earliest Egyptian, Babylonian and Hebrew writings all show that drunkenness existed even in those remote days, and do we not read in the Bible that after the deluge Noah was addicted to alcoholic excess? Legislation never has done, and never will do good to the temperance cause; it is a trite but none the less true saying, that you cannot make men sober by Act of Parliament; if anyone is disposed to drink to excess he will discover ways and means for doing so, be the difficulties never so great. In America the total prohibition of alcohol has been tried in certain States and signally failed. In some of the total prohibition cities of that country, surreptitious drinking exceeds that done openly in places where there are no restrictions; take, for example, the case of Charlotte City in North Carolina. According to an official report, 39,645 "whisky prescriptions" were dispensed last year at the drug stores of that city, the population of which is 35,000, and this after the prohibition law has been in force there for three years. Not so many years ago there was a naval captain—now deceased—who attempted to limit the consumption of alcohol by the officers under his command. He gave it as his opinion that no one should drink more than "three units per diem," his "unit" being a glass of Marsala. A wineglass holds about 60 cc., therefore one glass of Marsala contains about 10·5 grammes of alcohol, and con-

sequently a half-pint glass of beer, containing between 3 per cent. and 5 per cent. of alcohol, is for all intents and purposes equal in alcohol value to a glass of Marsala. Now Parkes, in his work on hygiene, says that a man leading an open-air life with plenty of exercise cannot take more than one pint of ale per diem without doing himself harm; therefore even the naval captain's modest allowance of three units per diem was, if Parkes be correct, slightly too much; but, with all due respect to Parkes, I would point out that as with infections, so with alcohol, it is impossible to lay down a hard-and-fast rule as to the amount which may or may not be taken, as the power of resistance varies with each individual.

That we are, as a nation, gradually becoming more temperate is an acknowledged fact. In 1899-1900 the average annual consumption of beer per head amounted to 32 gallons; in 1904 it was 29·7 gallons; in 1907 it had dropped to 27 gallons; and at the same time there was a reduction in the amount of wine and spirits consumed, so that it has not been a case of giving up one form of alcoholic beverage for another. In the days of Captain Marryat, drunkenness was fairly common in all walks of life. Readers of "Peter Simple" will remember how the sentry in a perfectly natural manner sang out, "Pass, naval officer, drunk on a wheelbarrow—and all's well," as each of the officers of H.M.S. "Diomede" returned in succession to the jetty, after dining, not wisely but too well, with the officers of the Gibraltar garrison. At the beginning of Queen Victoria's reign, it was the custom for the men to sit a long time over their wine after the ladies had left the dining-room; to put an end to this, Queen Victoria remained standing until the gentlemen came into the drawing-room, as Her Majesty was well aware that they would not keep her standing longer than the few minutes necessary for the drinking of coffee. Alcoholism, or the uncontrollable desire to drink to excess, is a disease, which may be, and generally is, acquired, but there are no doubt cases in which it has been inherited. Alcoholism affects all classes, but it is much more prevalent amongst the poor than those in well-to-do circumstances. It is met with in individuals possessing a small degree of moral resistance when sudden longings and desires are felt, amongst those, for example, who cannot see another person drinking without feeling an irresistible desire to do likewise. Social customs, in many instances, tend to perpetuate the habit of imbibing alcohol; at almost every social function, alcohol in some form or other is offered as a beverage; to refrain from offering alcoholic refreshment at such entertainments would

be to incur the risk of being regarded as mean, and this feeling is so deeply rooted that it appears to be ineradicable. Drinking habits are maintained to a great extent by the value attached to alcoholic beverages on account of their exhilarating and beneficial, or fancied beneficial, effects. Although the number of those who use alcohol is very great, the number who abuse it is comparatively small, which shows that the vast majority of moderate drinkers do not in time become heavy ones. Many writers on the subject of alcohol speak of it as a poisonous drug, but there are also many who say that the toxic properties of alcohol are much exaggerated. Dr. Starke, for example, has written an apology for the use of alcohol, in which he says it is not alcohol which at the present time is doing so much harm—it is the alkaloids contained in tea and coffee; alcohol, he says, is antagonistic to these. He is so convinced of this that he says if you are an abstainer from alcohol you should also abstain from tea and coffee. Dr. Starke finds that in those parts of Germany where much coffee and little alcohol are consumed it is there that so many cases of neurasthenia or nervous breakdown are met with, and not in the districts where alcoholic beverages prevail. At the XIVth International Congress on Hygiene, held last year at Berlin, Professor Hans Meyer, of Vienna, read a paper in which he said that alcohol, like carbohydrates, undergoes combustion within the organism of animals and plants, yielding a corresponding amount of heat; it is capable, in his opinion, of replacing any other heat-producing substance in the organism, an opinion which is supported by the experiments of Atwater and Benedict, quoted by Lieutenant-Colonel A. M. Davies, R.A.M.C., in his paper at the last annual meeting of the British Medical Association. Dr. Meyer says, however, that owing to the impossibility of storing alcohol in the system, it can only be regarded as a "food" in a very limited sense. That it is capable of promoting work under certain circumstances has been shown in the ergographical studies made by Frey, Mlle. Joteyko, and others. Analogous deductions have been made from certain experiments devised by Dr. Meyer, in which animals were kept in a hot closet, so that the processes of combustion in their organisms could not serve for maintaining the body heat; this was done in order to show that alcohol introduced into the system is capable of taking the place of the ordinary energy-producing substances. The researches of Stoklasa, Landsberg, and Reach have established the fact that perceptible quantities of alcohol exist in a normal organism, partly in a free state and partly in the form of esters (compound

ethers). Stoklasa has shown that alcohol is produced within the body from carbohydrates, and undergoes immediate combustion just as it does in vegetable organisms. The question naturally arises, if alcohol is a natural constituent or product of the animal organism, how is it that it is toxic? Meyer answers the question in this way: "Evidently everything depends on whether the conversion of such immediate products as alcohol, glycocol, lactic acid, and even sugar takes place at once, and in the right spot, where required; if, for example, alcohol, on being administered, could, like food and its products of decomposition, reach only the right place for its consumption, say, for instance, the muscles, it would probably be harmless, like its polyatomic cognates (glycerine, &c.). But it is here that the decisive difference shows itself, for while these are soluble in water only, alcohol is also soluble in fats, in lipoids; this property enables it to break through all membranous bounds, to intrude more or less quickly into all cells of the system, almost without exception, and cause disturbance in them as long as it remains therein. It displaces the lipoidal and the non-lipoidal protoplasmic constituents from their normal state of affinity. The chronic functional and morphological changes caused by repeated indulgence in alcohol may possibly be traced back to the changes in the cell membrane, which under the influence of alcohol becomes abnormally permeable, allowing of an abnormal exchange of matter between the cell and the surrounding tissue, which exchange still goes on for a time even after the alcohol is removed. It has been observed that all substances which are soluble in fats, and do not injure animal tissue, are narcotics, the power of a narcotic increasing according as it is soluble to a greater or less extent in fat. Compare ether with alcohol; ether is more soluble and therefore acts more quickly as a narcotic. There is every ground for assuming, says Dr. Meyer, that alcohol does not have any chemical action, in the narrower sense of the term, by way of combining with the substance of cells, either by substitution or direct union, but, like ether or chloroform, only acts by loose physico-chemical combination, in proportion to its state of concentration for the time being. . This affinity for lipoids naturally disturbs the natural state of equilibrium in the protoplasmic system, and this disturbance entails a functional change, *i.e.*, a toxic action; it may, according to circumstances, accelerate or intensify, or else retard, impede, or entirely stop the physiological processes in the protoplasm; in other words, it either excites or paralyses.

Dr. Rivers, in the Croonian Lectures delivered at the Royal

College of Physicians in 1906, dealing at some length with the ergographical experiments of Frey, Mlle. Joteyko, and others, comes to the conclusion that alcohol increases muscular work as recorded by the ergograph, and diminishes mental ; and that it increases work when administered to a person in a state of fatigue, and diminishes it if the fatigue is not already induced. Apparently mental fatigue acts as a muscular stimulant, in the same manner as, though to a smaller extent than alcohol. Dr. Rivers records some interesting observations in support of this statement, made upon himself, on one occasion when suffering from mental fatigue, and on another after an agreeable dinner party at which he had drunk two glasses of champagne; on this last occasion he obtained the largest ergogram he ever recorded. Dr. Rivers suggests that "at least one action of alcohol may be to depress the activity of some higher nervous mechanism which serves to control and keep in check muscular activity, and that when this control is weakened increased amounts of work can be executed." Schmiedeberg has suggested that all the apparently beneficial effects of alcohol are paralytic, and that the inability to appreciate the sense of fatigue enables one to employ the muscles effectively; in this he is supported by Bunge, of Basle, Kraepelin, and others. Dr. Meyer does not explain the action of alcohol in this way; he says: "It was formerly assumed in theory that the immediate effect of alcohol on cells was always one tending to diminish their function. But from the researches of the last decade we know beyond any doubt that immediate function-stimulating effects must also be attributed to it; take, for example, the well-known experiments on the intensifying action of alcohol upon the ciliary movement, on the excitability of isolated nerve-trunks and cut-out frogs' muscles, of the immediate excitement of respiration, and of the increase of muscular work which has been positively ascertained to take place, under certain circumstances, when alcohol in small doses is administered to man." The facilitation of muscular work by small doses of alcohol may be due to its exciting action on the central nervous system, whereby there is shortening of the time of reaction, and the readier setting up of motor impulses. Another factor may be the weakening of fatigue reflexes during laborious muscular work by the intrusion of alcohol, which acts as an energy producer, replacing the protoplasm yielding the fatigue poisons; this would at the same time explain the exceedingly rapid recovery of fatigued and famished persons when small doses of alcohol are administered.

Löd, Wood, Hoyt, and more recently Dixon and Bianchi, have

demonstrated that the action of the heart is actually intensified, and an increased volume of pulsation has followed the ingestion of alcohol. Dixon goes so far as to say that the action of alcohol is, in his opinion, directly nutritive and energy-supplying; it follows, therefore, that cases must arise where the rapid intrusion of alcohol into the muscular cells and its rapid conversion might be of decisive importance; in this case alcohol would be a physiological tonic in the actual sense of the term. Alcohol has an exciting effect—some call it a paralysing one—on nerve-cells, which may, as in the case of vaso-motor changes, be very desirable under certain conditions. Under the influence of alcohol the vessels in the cutaneous and muscular regions are relaxed, while in the region of the splanchnic nerve they are constricted. In the case of a heart unequal to the task of coping with the normal or morbidly intensified vascular resistance, this relaxation of the muscular and cutaneous vessels enables the heart to continue working; thus the judicious employment of alcohol may be life-saving. In 1906 Signor Bianchi published an account of his work on the action of alcohol on the heart and circulation in the Italian journal *Sperimentale* (1906, lxi., 1-2). The experiments were made on healthy subjects, and the doses of alcohol employed varied between 0·25 centigramme and 1 gramme per kilogramme of body-weight of the individuals experimented on. These last relatively strong doses were given to those who were to a certain extent accustomed to alcohol. I might mention in passing that a pint of beer drunk by a man weighing 10 stone is equal to a dose of 0·05 gramme of alcohol to the pound of his weight, or 0·1 gramme per kilogramme; this will enable one to grasp the significance of the doses employed with animals. The action on the peripheral vessels, measured at the wrist by means of the plethysmograph of Patrizi, is very noticeable with 0·25 centigramme of alcohol per kilogramme of body-weight. Ten minutes after the ingestion of this dose, which I should mention is diluted with an equal volume of water, the vessels of the hand dilate, notwithstanding that the normal dicrotism becomes more pronounced; after half an hour the changes get less and less marked, returning gradually to the normal. With 1 gramme per kilogramme the vascular dilation is considerable, the ascending line of each capillary pulsation becomes almost vertical, shortly afterwards it produces slight tachycardia, then little by little the vascular engorgement diminishes. In a corresponding manner arterial pressure falls in proportions varying with the dose. Measured with the sphygmomanometer of Riva-Rocci, it drops

12 mm. with 0·25 centigramme of ethylic alcohol, 16 mm. with 0·50 centigramme, and 30 mm. with 1 gramme. These experiments have been verified by experiments made on dogs. The action of the heart varies with the dose; small doses have no appreciable influence on the force of the heart nor upon its rate; the strong doses give rise to some tachycardia, which is accompanied at about the end of an hour by palpitation; these symptoms do not begin to diminish until about one hour and a half have elapsed. Alcohol has then an action on the cardio-vascular apparatus which is especially vaso-dilator and pressure-lowering, but we must not overlook the fact that for some time, at all events, it strengthens and accelerates the cardiac pulsations. The vaso-dilator action is so well known that all those who have had experience of severe cold are careful to avoid the use of alcohol so long as they are likely to be subjected to a low temperature.

A large number of experiments have been conducted on amœbæ and other lowly organisms with a view to ascertaining the effect on cell life; the results show that the effect is by no means so harmful as has been stated in certain avowedly anti-alcoholic works. The yeast plant has been able to thrive in a 10 per cent. solution of alcohol, but not in one containing more than 15 per cent. Starke has shown that the cells of the ciliated epithelium of the air-passages when isolated from the mucous membrane and placed in a slightly alcoholised solution, remain alive longer than they do when placed in a non-alcoholised solution. Much has been said as to the harm done to cell life by strong alcoholic solutions. Common salt, when applied solid or in strong watery solution, is equally fatal to cell life, and, like alcohol, is for that very reason used as a preservative; yet common salt is an important constituent of our blood, and as a 0·7 per cent. solution is less irritating than pure distilled water. Whilst fully realising the harmfulness of alcohol when taken to excess, it is reassuring to find that as the result of recent investigation alcohol used in moderation is not harmful. Common observation teaches us that there are many efficient healthy members of society doing just as good work in all walks of life as their total-abstaining brethren, who nevertheless take alcohol daily in amounts which should cause them to suffer from degenerative changes of the gravest possible description, if the case against alcohol were as bad as some would have us believe. Dr. von Baumgarten has recently carried out a series of investigations bearing out what I have just said. He injected solutions of alcohol of varying strength subcutaneously into dogs, rabbits, and guinea-pigs. He also

injected alcohol into the parenchyma of the centre of the cornea, and he injected physiological saline solution into the same animals under precisely similar conditions by way of control. Absolute alcohol and 96 per cent. alcohol, as one would have expected, gave rise to necrosis ; 70 per cent. alcohol only caused necrosis after repeated injections into the same spot. On the other hand, 50 per cent. alcohol and under did not give rise to necrosis or inflammation, even when the injections were repeated after several days interval. There were no macroscopic changes in the portion of the skin injected with alcohol in any way different from those where saline solution had been introduced, neither did the microscopic examination show any trace of inflammation or necrosis ; it was the same with the experiments performed on the cornea. Dr. von Baumgarten says the experiments with alcohol in regard to cirrhosis of the liver, as reported by different authors, are somewhat contradictory. Some experimenters have reported lesions which they refuse to regard as a true cirrhosis of the liver ; others have not found any trace of cirrhosis even in animals treated over a long period with strong doses of alcohol ; others, whilst disputing the possibility of alcohol causing cirrhosis, consider that it is able to bring about degeneration and necrosis of the parenchymatous cells. Dr. von Baumgarten's experience, working in conjunction with Herr Reiter, was that, even after repeated strong doses of alcohol given either subcutaneously or by the mouth, no trace of cirrhosis was ever found, but what he did find in the case of rabbits was that when they had died from acute alcoholism, at the level of the gastric mucous membrane there were numerous hæmorrhagic erosions, caused most probably by vaso-motor disturbance, with subsequent digestion by the gastric juice of those portions of the mucous membrane where the blood supply had been restricted. These experimental results are far from supporting the current belief that chronic alcoholism gives rise to necrotic and cirrhotic changes in the organs where connective tissue abounds, and more especially the liver. In support of the generally accepted view, says von Baumgarten, one sees many chronic alcoholics amongst those suffering from cirrhosis of the liver. But let us see if the converse also holds good. To judge from the statistical researches of von Hansemann, this is a long way from being the case. Dr. von Baumgarten, after making a large number of autopsies, of which a great many were on alcoholic subjects, thinks that the proportion of cases of cirrhosis of the liver amongst the subjects of chronic alcoholism does not exceed 5 or 6 per cent. This comparative

rarity of cirrhosis of the liver amongst the subjects of chronic alcoholism, coupled with the negative results obtained in the above-mentioned experiments, leads one to conclude that the abuse of alcoholic beverages only plays the part of a predisposing factor, the alcoholism giving rise to disturbances in the digestive tract which favour the absorption of certain toxic substances which are accidentally formed in the digestive tract and which are apt to induce cirrhotic changes in the liver. There is a widespread belief that the imbibing of alcohol tends to increase the power of resistance of individuals against infectious disease ; here we have no doubt a popular fallacy. Alcohol, even when taken in moderate doses, tends to lower the resisting power of the individual against disease ; when taken to excess it lowers it considerably. Pneumonia is one of the diseases singularly fatal to chronic alcoholics, and tuberculosis is another disease to which so many drunkards fall victims. M. Triboulet says that nine-tenths of the Paris workmen over 30 years of age who suffer from pulmonary phthisis are alcoholics, but he does not mention that most, if not all these workmen are also absinthe drinkers, and absinthe contains a highly toxic essential oil extracted from wormwood. The French Government, recognising that it is absinthe, and not alcohol, which is responsible for so much crime and suffering, have recently adopted stringent measures to prevent its manufacture in France, or importation from outside, but there are no restrictions against pure alcoholic beverages. M. T. Laïtinen has done a large amount of research work with a view to determining whether or not resistance to certain diseases is lowered. He found that 0·1 cc. of absolute alcohol per kilogramme of the animal lowered very considerably the power of resistance of rabbits and guinea-pigs against the toxin of diphtheria, there were 65 per cent. of deaths amongst animals treated with alcohol, as against 45 per cent. amongst the controls. The alcohol was employed as a 10 per cent. solution. The control animals which died survived the inoculation on an average twenty-one days; the alcoholised animals only lived on an average thirteen days. He also made a series of experiments on the red blood corpuscles, in which he showed that in animals treated with even small doses of alcohol the resistance to a hæmolytic serum was lowered. Small doses of alcohol had a distinctly injurious effect on pregnant animals ; out of ninety-seven young rabbits whose mothers had been given alcohol, 61·29 per cent. were born dead, or died within three days of birth ; the control animals during the same period lost 54·17 of their little ones. Very similar results were obtained by corresponding experiments on guinea-pigs,

the proportion of little ones viable being 63·24 per cent. amongst alcoholised animals, and 78·26 per cent. amongst animals treated with water. As regards weight, the average weight of the young of alcoholised rabbits was 79 grammes, whilst that of the control ones was 88 grammes. In regard to growth, the young rabbits treated with alcohol gained on an average 7·13 grammes per diem during the first twenty days, whilst the controls gained on an average 9·46 grammes per diem. The guinea-pig experiments gave very similar results. The conclusions to be drawn from these experiments are obvious. As I have already alluded to the heavy mortality of chronic alcoholism from pneumonia, I will not burden you with the statistics compiled by M. A. Karlson from cases occurring during the last few years at the Sabbatsberg Hospital, Stockholm; these merely prove an established fact. Before concluding, I should like to relate the result of an experiment on absinthe poisoning. Absinthe, as you are doubtless aware, is an alcoholic beverage which is extremely harmful, but it owes its toxicity not to the alcohol but to the small amount (0·33 per cent.) of oil of wormwood which it contains. The symptoms of absinthe poisoning are quite distinct from those of alcohol, it appears to act directly through the higher nerve centres, nervous symptoms being a characteristic feature; hallucinations, mental excitation, and homicidal tendencies are often seen amongst the victims of absinthe.

On July 20th, 1907, M. Aubertin read a paper at the Société de Biologie, Paris, on cardiac hypertrophy in animals subjected to slow absinthe poisoning. A rabbit which had died from absinthe cachexia after ten months intoxication was found to have a typical Traube's heart, with enormous hypertrophy of the left ventricle; the weight of the heart in this case had reached 22 grammes, whereas the weight of the normal rabbit's heart varies between 4 and 6 grammes, which is about $\frac{1}{400}$ of the total weight of the body. In animals the subjects of experimental nephritis, the heart undergoes hypertrophy, and its weight may reach as much as 12 grammes, or a proportion to total weight of body of 1 in 208. In our absinthe-poisoned rabbit the proportion of heart to body is 1 in 177. This cardiac hypertrophy is then much more considerable than that which is met with in animals suffering from chronic interstitial nephritis; in the case of the rabbit treated with absinthe there was no alteration in the interstitial portion of the kidney, this organ showed only some recent cellular lesions. On the other hand, there were no valvular lesions of the heart, no atheroma, nor histological lesions of visceral arterio-sclerosis capable of explaining the

hypertrophy of the left ventricle. One should observe that the suprarenal capsules were double their normal size, and showed both cortical and medullary hypertrophy. In this case we have enormous cardiac hypertrophy of the left ventricle in conjunction with hyperplasia of the suprarenal capsules without any chronic lesion of the kidney, as you would expect to find.

The conclusions which I have come to in regard to the use of alcohol as a beverage are as follows: Alcohol in general, and malt liquors in particular, are to a certain extent foods capable of supplementing a mixed diet, and as aids to digestion are often of great value. The amount which any individual can take with benefit, or at any rate with impunity, depends entirely on the bodily state of the individual and the nature of the life he is leading. A man leading an active, open-air life can take without detriment much more than one whose existence is sedentary and indoors. The evil effects of over-indulgence in alcohol are familiar to everyone, and those whose will-power is so weak that they are incapable of controlling their desires or passions should eschew alcohol entirely, but in my opinion all attempts to *enforce* total abstinence are not only futile, but mischievous. Pregnant women and young children should avoid alcohol. The idea that alcohol enables one to resist infection is, as I have endeavoured to show, a popular fallacy. Laboratory experiments with the ergograph have clearly shown that alcohol under certain conditions can facilitate and increase muscular work, but I will not speculate as to the actual manner in which it brings this about. I think it is generally admitted that men, such as navvies, engaged in arduous manual labour requiring no mental effort, work as a rule better with moderate amounts of alcohol than without it, whereas alcohol undoubtedly hinders mental work where any of the higher mental processes are called into play, except in those cases where the individual is suffering from actual fatigue.

DISCUSSION.

Lieutenant-Colonel A. M. Davies said that the discussion of this question had always been attended with difficulty on account of the side issues involved. It is not only a physiological, but also a social and moral problem that has to be solved. More prejudice has been introduced into this than into almost any other subject of medical or physiological research. Even now there was no unanimity as to the physiological action of alcohol. The advocates of total abstinence assert that it is a poison, as to which there can be no doubt; they also deny that it is a food: but here, if a food is a substance which can produce heat and

energy without deleterious effect, it is not correct to deny that alcohol is a food, although of course it does not form tissue. In 1870-1872 the late Professor Parkes and an officer of the Army Medical Service, Count Wollowicz, conducted experiments which showed that alcohol is excreted unchanged only when it is taken in relatively large quantities. This has been denied over and over again, but the most recent researchers, at any-rate the majority of them, uphold this view. Atwater and Benedict (1902) determined that a moderate quantity of alcohol was utilised as a heat-producer, just as well as starch or sugar, less than 2 per cent. being excreted unchanged, *i.e.*, not utilised. At the British Association, 1907, Professor Cushny bore out this statement; over 95 per cent. of the alcohol ingested is, according to this observer, utilised. Dr. Rivers, in his Croonian Lectures (published 1908), stated that small doses of alcohol (5 to 20 cc. absolute alcohol, *i.e.*, up to 14 oz. beer [at 5 per cent. strength], or up to 23 oz. at 3 per cent. strength) have no effect on the amount or nature of the work performed. Lastly, Dr. Waller, at the British Association Meeting in 1908, in answer to the question, Is alcohol a food for muscle? preferred to say nothing further than that under the influence of a weak solution of alcohol the muscle did increased work. From the physiological side, therefore, it seems that our present knowledge justifies the assertion that alcohol is a food. This does not, however, prove that it is either necessary or advisable as an article of diet. Lieutenant-Colonel Davies said that, in his opinion, alcohol was *not necessary under any circumstances* as an article of diet. Its therapeutic use is another matter altogether.

As to the use of alcohol in the Army under the conditions of Service, we have to consider the conditions of climate, forced exertion, and the special fatigues and exposures of war. As to climate, there is ample evidence from the experience of Arctic voyagers and Alpine guides and climbers in regard to cold, and from Indian experience as to heat, that alcohol is markedly injurious. As to exertion, the evidence is equally strong; no alcohol should be taken before any considerable bodily exertion, such as a march on service, &c. Instances were quoted of campaigns conducted in great cold and great heat (Red River expedition, 1870; Nile campaign, 1885) without alcohol. A very small spirit ration may be beneficial under very special circumstances, as towards the end of a long march, when it is an urgent matter to reach camp before dark, and the men require a spur.

Lieutenant-Colonel Davies referred to two alterations that had been recently brought about in the interior economy of the Army, both of which, he thought, would tend to moderation in drinking. These are: (1) Provision of beer and mineral waters to be consumed at the time of the men's dinners; and (2) the provision of beer in the recreation rooms, as well as in the canteen. Both the measures, he believed, would greatly discourage excess in drinking in the Army. Those who thought that all

use of alcohol, even in the slightest quantity, is harmful, were of course opposed to such measures as these; they desired the entire abolition of the canteen, and would prohibit troops from obtaining beer or any intoxicant in barracks. This had been done in the United States Army with results that were prejudicial to discipline (increase of desertions, and of fines by court-martial), to thrift (diminution of sums deposited by soldiers in savings banks), and to health (alcoholism and venereal disease having increased). Instead of procuring alcoholic liquor under regulation within barracks, the men went outside to obtain it in unregulated saloons and brothels. A similar state of things is reported to exist in the French Army, where the sale of spirits has been forbidden since 1900 within barracks, though wine and beer may be obtained; the brandy shops in the neigbourhood of barracks have increased, as has the prevalence of alcoholism amongst the troops. The moderate provision of an alcoholic beverage, such as beer or light wine of moderate strength, and under strict but sensible regulations, would tend to temperance on the whole; as experience had shown that total abolition of such moderate consumption was followed by all the physical evils of excessive consumption of alcohol, and with a greater number of breaches of discipline. Happily, in the British Army, both at home and abroad, drinking is diminishing and temperance is increasing. This is taking place at a steadily increasing rate, and without any irritating restrictions or undue interference with the men's liberty.

Sir Victor Horsley said he was extremely interested in taking part in the discussion, because the question had been prominently raised as to whether alcohol was to be regarded as a food or not. He had not heard, however, as to what people meant by alcohol acting as a food. Colonel Davies had said that it was a food, and that a food was something producing heat and energy. It was the old story of the mistake of employing popular language to express scientific facts. We had no right to call a substance a food which could not be advantageously utilised in the body. With reference to what Colonel Davies had said as regards taking alcohol in general, he agreed with Professor Dixon, who said that if a man wanted to do any work and took alcohol he would be a fool; and as regards taking alcohol as a sleeping draught at night, his opinion was that men did not require sleeping draughts if they got enough work to do. Though alcohol was partly oxidised in the body, and heat resulted therefrom, the net result, by reason of peripheral vaso-dilatation, was a fall of temperature; it was therefore not of use, but injurious to the body. As regards it being considered as a food for the production of work, no one with any knowledge of military experiences would accept any results on the use of alcohol as a food likely to produce muscular energy. He also pointed out what a principal part alcohol played in the spread of tuberculosis. In conclusion, he said he had no right to encroach further on the time of the meeting, but suggested that we

wrong

There are many cases of sleeplessness besides insufficient work. a man may have plenty of work to do yet suffer from insomnia

ought, on the question of alcohol, to take our stand from the point of view of national physical degeneration. He did not think, whatever our view may be, that we were justified in representing to the public that a man might take alcohol if he liked it. The death-rate among moderate drinkers was higher than among abstainers; the incidence of sickness-rate was higher than among total abstainers. Under these circumstances, he thought we ought to teach that it was a higher national duty to adopt total abstinence rather than indulge in so-called moderate drinking.

Dr. E. I. Spriggs congratulated Fleet-Surgeon Andrews upon the comprehensive outlook of his paper. He said, further, that whilst pharmacology had shown that ethyl alcohol was a depressant, an enormous number of experiments had been made with the object of discovering other effects which might be beneficial when depression was not needed. It was striking to notice that whilst methyl, ethyl, and propyl alcohols and others all belonged to the same series and were classed as depressants, no attempts were made to show the beneficial effects of any other members of the group except ordinary alcohol. It was pathetic to note how many pages were devoted in some works on drugs to an explanation of the good effects of alcohol; and the impression was sometimes conveyed that the author was more anxious to defend a custom than to make a strictly scientific enquiry. Although tea and coffee were, no doubt, frequently abused, Dr. Spriggs did not think that anyone whose work had taken him among the lower classes of our great towns could pretend for a moment that the harm done by their excessive use was in any way comparable to that done by alcohol. He differed from Sir Victor Horsley in that in his (Dr. Sprigg's) opinion it had been definitely proved by metabolism experiments that alcohol could act as a food. This result is, however, of little value, since in order to get the most marked effect the subject of the experiment should be a teetotaler. Again, alcohol did not act immediately as a food in a person, but only after an interval of four or five days; in cases of disease it is often not possible to know beforehand at what date the food effect of alcohol will be required. Sir Victor Horsley's criticisms of the ergographic method employed by Dr. Rivers had interested him very much. Supposing, however, that the method was sound, and taking Rivers' results as they stood, he did not think that Dr. Andrews' conclusions from them were justified. Rivers pointed out that general fatigue was composed of mental fatigue and muscular fatigue. He found that alcohol increased mental fatigue, although it diminished muscular fatigue, and he attributed the latter effect to the mental fatigue produced; that is, to the removal of control. The result of increased muscular work is, therefore, a spendthrift result. There are many conditions, however, when this might be useful; when, for instance, a sudden effort was required for a short time. But, as Dr. Rivers mentioned in his lectures, when the effect of alcohol on general

fatigue had been examined by observations made in campaigns, the results pointed strongly to the conclusion that, taking the body as a whole, alcohol is prejudicial to the capacity for work, and in no way helps to diminish the effects of fatigue. He did not agree with Dr. Andrews that cirrhosis of the liver should not be attributed to alcohol. His clinical experience, like almost everybody else's, was entirely in favour of a connection between alcohol and cirrhosis. Although in some cases cirrhosis might have arisen from other causes, that did not show that the majority of cases were not due to alcohol, any more than the occurrence of peripheral neuritis as the effect of various poisons excluded alcohol as a cause of that condition. The argument that only a small percentage of chronic alcoholics got cirrhosis seemed to him to be of little value. Many a man might receive a blow, but only a few be knocked down; nevertheless, in those few the fall was the result of the blow. It was sometimes said that cirrhosis was not directly produced by alcohol, but indirectly through the gastritis and enteritis of alcoholism. This might be so, but it made no difference to the observation that the cirrhosis was caused by over-indulgence in alcohol. He was interested in Dr. Andrews' remarks on the effect of alcoholism on pregnancy; he had recently read a summary of a large number of family histories collected in Germany, in which it was shown that, as compared with other families, the proportion of women unable to suckle their children was much greater, not only in alcoholics themselves, but in their offspring. In practice he gave alcohol whenever he thought it would do good, but in view of the serious depressing effects on the heart, which had been shown pharmacologically, he thought that it should be administered with the very greatest care, and used it himself but seldom, and then almost entirely as a narcotic. The old-fashioned therapeutics in which alcohol was given for almost every complaint had one great advantage—namely, it was so easy. It was always possible to quote wonderful cases of the recovery of people in extreme illness after the exhibition of alcohol, but if the result was less favourable, as it often was, it was not fair to assume that this was in spite of the alcohol given. He thought that the more the matter was enquired into from an unbiased point of view, on the pharmacological and therapeutical basis, the more would this drug tend to be used with extreme care.

Sir Havelock Charles said: In a discussion on the alcohol question you have very contrary opinions advocated. On the one side there is the faddist, who says it kills the cells of your body, ruins the nutrition of the tissues, destroys the organs and their functions, throws out of gear the workings of the various systems; and generally that it is a poison to the protoplasm of all kinds. In this diatribe there is a germ of truth. On the other side there are the *abusers* of the *use* of the drug—the men of perverse views—who say they take it as a help to health, as a protector from pestilence, as a mainspring of good, an escape from evil, a giver of

life, and a shield from death. Between these opposite camps there is the way common-sense points out—the middle way—which says that it is neither good, nor is it all evil, but, like other things in the world, has its use and should not be abused. The drink problem, truly, has been coeval with the history of mankind, and during the stress and strain of the process we term civilization man has sought out many inventions, some helpful, and not a few harmful, according to the use made of them. The learned reader of the address to-night has introduced the name of Noah. He, in addition to being a shipbuilder of note, was also a grower of vines. His little excess whilst resting under his own vine, without a fig-leaf, has handed down to us the prying methods of a telltale and a busybody. Alcoholic effects furnish even nowadays material for such individuals. Temperance legislation has been decried, but some endeavour should be made to direct the drink traffic in the road least harmful to our nation; and the patriot's sympathy will be with those who *try* to do something, *not* with those who theorise in their armchairs and do nothing. No portion of the community has any right to benefit and reap riches by reason of the frailty of the weaker brethren. The shareholder in a gambling casino, when the law finds him, is not listened to on his shouting "My private property is being robbed"; neither should those waxing rich on the liquor traffic have a hearing when the voice of the people speaks for the future welfare of the nation.

All are agreed that there is harm in taking *much* alcohol. Few agree as to the *minimum*. This is a matter of *personal equation*. The danger signals are fairly understood. When they appear, total abstinence, and total abstinence only, is the remedy. My personal opinion is that the amount of alcohol that can be taken, without harm, by the young is *nil!* Everyone would do best to abstain till 30 years of age, and then, at that time of comparative discretion, let each use his judgment.

Much is said of the spread of temperance in England. Possibly; but, to me, on returning after many years, the most awful sight in London, and in many of the provincial towns, has been that of seeing the women—not few, but many—in the bars! This was not so bad twenty-five years ago. Truly this is the worst side of the drink traffic. This way lies the decadence of the nation. The uncontrollable desire to drink is partly acquired; when there is the history of hereditary taint in addition, only total abstinence will give safety to such a person.

It is a poor heart that never rejoices! and when, in our social customs, our hearts warm to old friends and to old memories, should we look on the wine, when it is red, when it moveth itself aright in the cup, let us do so without subsequent diplopia, or other physiological disturbance. Let such liberty be for those with vigour of soul and sturdiness of body, not for the callow youth of uncertain moral backbone. Let no one be a Vitellus for food, or a Silenus for wine, but temperate in the use of both. Practical men in India, who have had much experience of the profession

there, will be unanimous in saying that more evil than good follows on the use of alcohol there. I am fairly familiar with the conditions of life in Asia, from its centre to its south, and have had to do with military, civil, and native surroundings. I say deliberately that the men of grit and the hard workers amongst them all were those who either totally abstained from alcohol or very strictly limited its use. There are exceptions. One financial expert—of him his friends said, "Oh! So-and-so's opinion when he is half drunk is better than that of the best man when sober." An old veteran of the Sikh wars and the Mutiny told me that for thirty years he had drunk at least a bottle of brandy a day! He was then 70 years of age, and about to cross the Bar, on the other side of which I hope there will be the drop of cold water for him. These are freaks. They form the dangers, whose example and temporary impunity lead many a feckless one into great jeopardy.

As to the abuse of tea and coffee, well and good. But it is no argument in favour of alcohol. Make the tea well, and it is ever a "stimulant," with no sting in its tail in the shape of a subsequent depressing effect, no reaction stage, no tissue degeneration in the body. It is *the* drink *par excellence* from the snows of the Pamirs to the scorching sands of Rajputana. I have tried it and seen its effects. Coffee is not as good, as in certain liver affections it is ill borne, and has appeared to me, in some cases, to be as injurious as alcohol. Alcohol is certainly in a very limited sense a "food." I should ever put the word "food," used so, in inverted commas. It is a drug, and I would say here, a drug that should be withheld in cases of tropical liver and also with tropical bowel. This is not sufficiently acted up to, with the consequence that convalescence, in such cases, is often much delayed, and therefore I say in these, "Stop all liquor!" As to alcohol increasing muscular work when administered to a person in a state of fatigue, of this I have a doubt. But I have no doubt whatever that for such a purpose a bowl of hot tea, well prepared, is infinitely preferable. I base this on considerable experience in marching, hill-climbing, and jungle work. My life has in every way been a strenuous one, and I made it a point of never touching alcohol when I wished to get the best out of myself, physically and mentally. When a craving to shift life's burden a little comes on, and a desire to get temporary oblivion from the troubles and anxieties of others, which members of our profession have to carry, then a pint of champagne at night, with a *very* light dinner, makes the worry vanish and brings again the bright side of the question into view. If there be an evil in this I think the consequent pleasure outweighs it. That alcohol is a daily necessity is *not* my view. I am very strongly of opinion that it is *not* a necessity, and, that it should, if used, be taken only now and again, as a drug, when judgment indicates its use. The working man in India would complain less of the climate and its ill-effects did he follow this method.

As to the form of alcohol suitable, the personal equation comes in. Malt liquors cannot be taken with impunity long in India. Open-air exercise, and plenty of it, may enable one to use them. The weak whisky "peg" is the safer drink for the sedentary and indoor worker, He and all should beware of the dangers of an excess of ice-cold drinks! Personally I would say, take alcohol very seldom. When you do, get the best. If there be an age to take it, it is over 30 years. There is a *how* to drink it—with temperance ever, and total abstinence if in doubt. There is a when to drink—never between meals, and only after sundown.

Fleet-Surgeon Collingwood said: It would be interesting to know if the lecturer could give any explanation of the acknowledged facts that many Asiatic races—Arabs, Persians, Malays, Siamese, &c., who are, I believe, abstinents—nevertheless occupy an inferior position to European races, both in social type and conduct, and that even in Europe we find that those nations who drink a great deal, and often to excess, are at the top of the social scale. Compare Germany with Italy, or whisky-drinking Scotland with sober Turkey. I trust from these remarks that it will not be thought that I am an advocate of anything but drinking in moderation. In reply to one of the speakers, who said that alcoholism is responsible for the diminishing birth-rate, I would point out that doubtless there are many factors producing such a result, but that it must not be forgotten, as taught by Herbert Spencer, that Genesis varies with Individuation. The higher and more complex the organism, the lower the rate of increase. This can be seen in the animal kingdom; fishes have thousands of eggs, birds only a few, mammals fewer still at a birth, and man, as a general rule, only one. Savages breed more freely than civilised people, and even amongst the latter it is the lower classes that have the most children. Rank weeds grow apace. Quality is often more important than quantity: "a form in which the amount of life shall be the greatest possible, and the births and deaths the fewest possible."

Dr. Collinson, in making a few remarks on the question as to whether alcohol acted as a food or not, said he certainly thought that those who did not take drink, or rather were total abstainers, were much larger eaters than those who partook of alcohol, and he was of opinion that in some instances where alcohol was not taken in excess, but moderately, it might have a beneficial result. He referred to it as acting as a lubricant. He said, you will find that where tea and coffee are taken in excess, instead of alcohol, there is a liability to a certain amount of nervous breakdown, and generally those who take tea and coffee in excess suffer from anæmia.

Fleet-Surgeon Andrews, in reply, said: I wish to thank those who have been kind enough to support me by attending this meeting and taking part in a discussion which cannot fail to be of interest to everyone. Sir Victor Horsley has raised many points of physiological interest which, even if time permitted—which it does not—would require one more versed

in physiology than myself to reply to satisfactorily, but I think there is one statement of mine which Sir Victor Horsley has challenged, which I cannot allow to be passed over in silence, viz., that "*alcohol is a food to a certain though limited extent.*" This I maintain is true, and I am glad to see that here I have the support of Dr. Spriggs. Alcohol, in my opinion, is a food, and laboratory experiments, as well as everyday experience, confirm this view. Alcohol is, moreover, a valuable adjuvant to food in many instances, which might not inaptly be compared with the oil which lubricates a steam engine; the oil does not in this case supply the energy, but it lessens the work required to be done by diminishing friction. I maintain that alcohol does act as a true food in a limited sense. It is well known that total abstainers are as a rule great eaters; in many instances they are more than this, they are voracious. If, then, non-abstainers eat less, and accomplish as they do the same amount of work, it is evident that alcohol must either check metabolism or serve as a food; in my opinion it does both. I am glad to see that Colonel Davies is quite in accord with all I have said, but I am particularly pleased to see that his experience with regard to prohibition agrees with what I have said. As another example of the mischievousness of restrictive legislation, I might mention that not long ago it was the custom on at least one of the great American railways for the guard in charge of the trans-continental trains to warn the passengers before entering a total prohibition State, that if they wanted drinks during the day they must lay in a store beforehand. There is no doubt that in cases of this sort, owing to the perversity of human nature, more drinks are consumed than if there were no such restrictions. Colonel Davies alluded to a pony he had known which refused to work without its ration of alcohol; this reminds me of that picturesque story by Alphonse Daudet in his "Lettres de mon Moulin," entitled "La Mule du Pape," where that animal bore a grudge during seven years against the rascal Tistet Védène, because one evening it was deprived of its customary bowl of hot spiced wine. Fleet-Surgeon Collingwood has asked whether those nations which are abstainers from alcohol show a superiority over those which are non-abstainers; the answer is decidedly, No. In matters of social purity and morality the total abstinence nations show little which is worthy of emulation. It is a remarkable fact that the further north you go the more alcohol is consumed, and yet it is the northern races which are the ruling ones. I do not attribute the superiority of alcohol-consuming nations to the fact that they consume alcohol, so much as to the fact that amongst them there is a very large proportion of men of sufficient grit and character to resist the temptation to abuse alcohol. I think it was this resistance to temptation, and the benefits accruing therefrom, which led that distinguished prelate, Archbishop Magee, to say "that he would rather see England free than sober."

Sir Alfred Keogh then thanked Fleet-Surgeon Andrews for the very

excellent paper read to them that evening which had provided them with a very interesting discussion. He also said that he was sure the thanks of the Society were due to Sir Victor Horsley for his coming to the meeting to join in the discussion. General Keogh went on to state that we live in the Army an organised body, and should have numerous workers investigating the subject. He hoped the discussion to-night would show the necessity for taking up the subject. It was a very important one both to the Army and the Navy. He was very much struck by the manner Sir Victor Horsley in his speech placed before them the question of alcohol and our relations to the public. He had often heard medical men express opinions which amongst themselves might be arguments, but which among the laity could not be productive of beneficial results. General Keogh again expressed his thanks to Sir Victor Horsley and the other gentlemen taking part in the discussion, and the meeting terminated.

Clinical and other Notes.

NOTE ON THE SIMULTANEOUS OCCURRENCE, IN TWO INDIVIDUALS, OF THE INFECTING AGENTS OF MALARIAL FEVER AND ENTERIC FEVER.

By Captain A. B. SMALLMAN.
Royal Army Medical Corps.

The question of the co-existence of typhoid fever and malarial fever is one which has been much discussed in the past, and the terms typho-malaria and malaria-typhoid have been used, especially in America, to describe a condition which was looked upon as a combination of the two diseases and also as a separate entity. At a later period, however, it would appear that these terms fell into disrepute, as the following extracts show :—

"Typho-malarial fever is an ordinary typhoid occurring in a person who has been exposed to malarial influences, *i.e.*, who has become infected with the malaria parasite."—Manson, "Tropical Diseases," 1903 edition.

"Typhoid fever and malarial fever in rare instances may co-exist in the same patient. Of nearly four hundred cases of typhoid fever, all with blood examinations, and a majority of them coming from malarial regions, in not a single instance were the malarial parasites found in the blood."—Osler, "The Principles and Practice of Medicine," 2nd edition.

"Occasionally the two infections may exist simultaneously in an active stage, as in a case reported by Craig."—Allbutt and Rolleston, "System of Medicine," vol. ii., part ii., 1907 edition.

Recently it has fallen to my lot to meet with two cases (in a series of about forty cases of enteric fever) in which benign tertian parasites were found in the blood film, while within a day or two cultural methods demonstrated the presence of the *Bacillus typhosus* in the blood-stream. The details are as follows :—

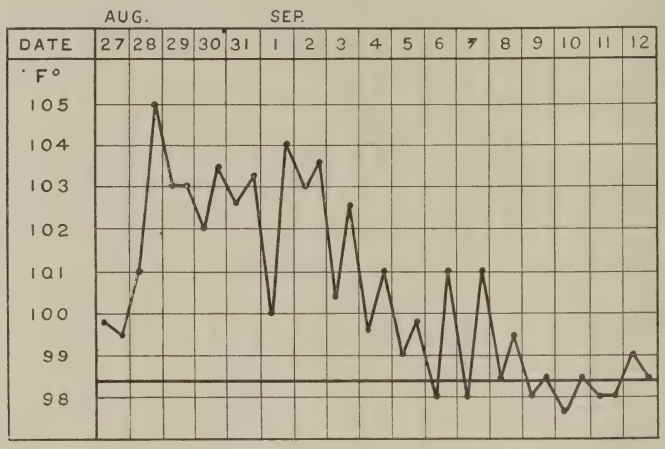
Private M., admitted to hospital with "fever" on August 28th, 1908. Blood film examined the same day showed benign tertian parasites. Blood culture was made two days later and *B. typhosus* was obtained in pure culture.

Private Y. Benign tertian parasites were found on September 13th, 1908. He was admitted to hospital on September 15th, and a blood culture was made the same day. The *B. typhosus* was obtained in pure culture.

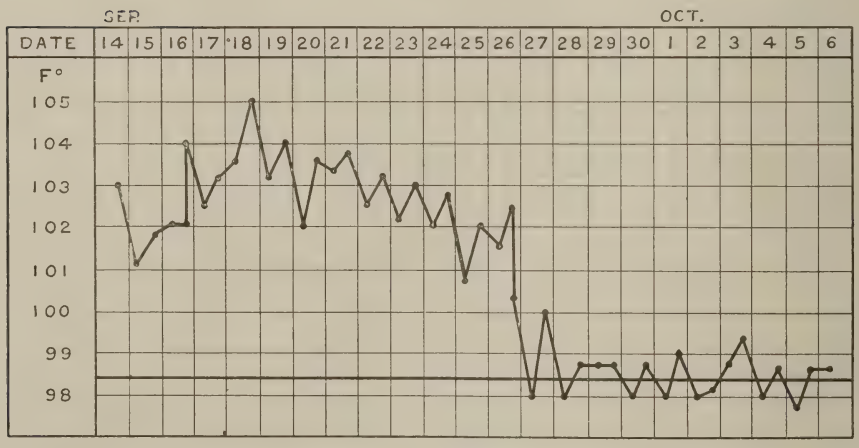
The temperature charts are appended. It will be seen that Case 1

shows no periodicity; Case 2, however, shows it on the sixth, eighth, and tenth days of the disease.

It would be interesting to know how the diagnosis was arrived at in the case referred to above, reported by Craig. I am unable to refer to the original article, but if it should be that the typhoid part of the double



Case 1.



Case 2.

infection was not diagnosed by means of cultivating the organism, these two cases may, perhaps, be allowed to stand as the first recorded examples in which the causal agents of the two diseases have been demonstrated in the same patient at the same time.

It would also seem that, in India at all events, the occurrence of the two diseases in one individual is not so rare as indicated by Osler.

NOTES ON THE TREATMENT OF CHOLERA.

By Captain J. A. BALCK, V.H.S.,
Royal Army Medical Corps,
And Lieutenant A. HARPER NAPIER,
Indian Medical Service.

In the spring of 1908, cholera, which of late years had become almost extinct among Europeans in the Punjab, showed signs of recrudescence. A few isolated cases were succeeded by others, and finally an outbreak occurred among the 1st Royal Munster Fusiliers, while the Battalion was stationed at Shabkadr during the Mohmand campaign. It was our lot to be intimately associated with this outbreak as medical officers in charge of the Cholera Hospital.

The epidemic commenced on May 12th, the first case coming in at 3 a.m., and others following in rapid succession. At 10 a.m. the section of Field Hospital which had received the cases was moved a couple of hundred yards away. The stream of cases continued during the rest of the day, and at midnight seventeen cases had been admitted. On the following day (May 13th) twenty more cases came in. Military exigencies required on this date a fresh moving of the hospital. The new ground was also, incidentally, a much better one, as instead of in a ploughed field, the tents could be pitched in the shade of a grove of trees. On the 14th there were signs that the outbreak had exhausted itself, the admissions falling to four; and on the 15th the last case from the regiment came in. The heat now grew excessive, and on the 19th it was resolved to remove the remaining cases into Peshawar. This was carried out on the 20th, but the same day was marked by a final admission in the shape of one of the orderlies, who, we regret to say, ultimately succumbed to the disease.

The mortality of the cases was relatively severe; out of forty-three admissions, thirty-two ended fatally, very nearly 74·4 per cent. If we add to this the two deaths which occurred later in Peshawar among the men transferred there, the mortality becomes one of nearly 82 per cent. Of these thirty-two fatal cases eight died on the day of their admission, and seventeen on the second day; the remaining seven, having got over the acute stage of the disease, died later from complications. A factor which we think entered largely into their case was the heat, which under canvas in May in India is severe, and told heavily on the constitutions of men already weakened by disease. It was this consideration which determined the resolve to remove the remaining cases into Peshawar Cantonment. The result as regards the patients was happy, and no spread of the disease followed from what may have been a somewhat hazardous resolve.

The signs and symptoms call for little remark. They were of the

classical kind to be found in any text-book. The only one which we did not notice in any handbook at our disposal was the characteristic odour of the stools. It was difficult to describe: somewhat mousy, and at the same time slightly sour. It is, however, one which neither of us will ever forget.

Of complications, the most distressing was suppression of urine in the convalescent cases, and this we found very hard to deal with. What Manson calls "cholera typhoid" was also common, and vomiting was a marked feature in several cases. Hyperpyrexia occurred in only one instance.

If we venture to dilate on the methods of treatment employed, it is because we were to a large extent groping in the dark and feeling our way. The statements in the text-books are vague, and, while giving valuable indications, leave the details as to quantity and method of administration very largely undefined. The treatment *par excellence*, is by saline injections, and of these the intravenous is vastly preferable to the subcutaneous. The reaction to the former is much quicker, and cholera is essentially a disease where time is an object. The quantity which can be administered intravenously is also greater. Large quantities, not less than two quarts, should be given at each injection. Moreover, there should be no hesitation in repeating the same at short intervals, even as short as half an hour; and this repetition should be persevered with, even though the results may appear discouraging. This was brought home to us by one of our cases. The man, Private K., who had been doing well, suddenly took a turn for the worse, and his pulse began to fail. Four pints were injected intravenously with marvellous improvement, which, however, was evanescent. Twenty minutes after the injection had been stopped, the pulse was again barely perceptible. The injection was repeated with the same result: temporary improvement followed by a rapid decline. The question of giving a third injection was debated, and it was finally decided upon rather as a desperate remedy than from any real hope of doing any good. But this time the pulse maintained its vigour, the patient never looked back, and is one of our recoveries.

The strength of the solution is, we think, of little importance. We tried both the normal saline and the double-strength solution recommended by Rogers, and cannot say that one acted appreciably better than the other.

The method was as follows: The vein selected (the median basilic) was cut down upon and ligatured, the ends of the ligature being left long. An opening for the cannula was made on the proximal side of the ligature, but the cannula was not tied in. On the conclusion of the injection the wound was dressed by a pad in the ordinary way, no further ligature being found necessary. Should it be needful to repeat the injection, the long ends of the ligature are most useful in raising the vein from the

tissues and helping to find the opening. A vein could be used for about two or three injections, after which the other arm would have to be resorted to. A clot was frequently found in the proximal end of the vein, and a danger always to be kept in mind was that such a clot might be dislodged into the general circulation, with possibly fatal results. For this reason, unless the second injection followed the first very rapidly, we preferred to use the other arm. In not one of our cases, however, did this accident actually occur, though it is possible from the history that in one of those who died later at Peshawar pulmonary embolus was a contributory cause.

In a few rare cases the median basilic was non-existent, being replaced by a plexus of small veins. Here we had to resort to subcutaneous injection, as also in those cases where both arms had already been used.

It may just be mentioned that in desperate cases it was found of great service to give strychnine, not hypodermically, but by injecting the contents of the syringe into the funnel containing the saline. The strychnine thus entered the blood-stream directly, and 5 minims of the liquor could be distributed over two or three funnelfuls with excellent results. Of drugs very few proved of the slightest use. In our early cases we tried the administration of liq. hydrarg. perchlor. with or without opium, but cannot say that it appeared to have the slightest effect on the course of the disease. Bismuth was equally ineffectual. Strychnine, ether, and digitalin were of course invaluable in cases of collapse, either between saline injections or reinforcing the same. Adrenalin we did not have with us.

As regards individual symptoms, the best thing found for the often distressing cramps was massage. We also gave atropine hypodermically for these, and it probably had some slight effect in lessening them. For the vomiting the usual remedies were given, but we cannot say that any one proved very successful. The diarrhœa also of the cholera typhoid period proved very little amenable to treatment. Starch and opium enemata, large astringent enemata, as well as the usual sedatives and astringents, were all tried, but we cannot say with much success. The most troublesome symptom, which proved fatal in several cases during the convalescent stage, was suppression of urine. We tried hot baths, fomentation, cupping, and such diuretics as were at our disposal, in vain. The only method which proved at all successful was the following: Finding digitalis by itself no good, we tried giving calomel, gr. $\frac{1}{2}$, at night, and tinct. digit. with pot. citrat. four-hourly the next day. It is an old method in cardiac cases with failure of compensation and scanty urine, and certainly acted well in the two cases to whom we gave it. As, however, these two were the last cases in the epidemic, our experience is too small to say definitely what value it had. Still, in similar cases we should always give it a trial first.

The diet consisted of beef tea, milk, chicken-broth given in two-hourly feeds in quantities of 4 ounces at a time. We used, as far as possible, to ring the changes on these foods. In the first cases we gave ½ ounce of brandy in each feed, but later reduced this. The patients themselves disliked the brandy, and we did not find it had much effect on the course of the disease. Champagne did not prove a success. The patients could with difficulty be induced to take it, and when given it did not seem to stimulate much. Gin was tried with the idea of getting the advantage of its diuretic action, but we cannot say that it had much effect one way or the other.

Finally, it may prove of some interest to mention the measures of personal and general hygiene we adopted. The camp was divided into two sections, the observation section and the cholera section, and a separate staff kept for each. The observation section consisted of two tents, A and B. One of these (A) was kept for fresh admissions, and in it the patient was placed on arrival in hospital. Should he prove to be cholera, he was moved on into the cholera section. Should he be merely diarrhœa, of which a fairly large proportion came in, he was transferred to the second tent (B), and from there sent as soon as possible to a segregation camp under the regimental medical officer. The object, of course, was to limit as far as possible the time in which a cholera and non-cholera patient might be in the same tent. A patient brought all his kit with him, and this was in every case, when he proved to be a case of cholera, ultimately destroyed. Of course, under active service conditions, where the supply of hospital clothing is limited, it had to be very largely utilised first. The equipment did not follow the patient further than the entrance into the hospital, unless it was fouled by choleraic discharges, when it had to be destroyed.

The cholera section consisted of "day" and "night" tents, with separate bedding in each, and the patients were, after the morning and evening washing, moved from one to the other. This gave the soiled ground a chance of recovery. The tents, when vacated by patients, were opened as far as possible, the ground sprinkled with phenyl, and swept, and exposed to the air for twelve hours, so as to be comparatively sweet when reoccupied. The moving twice daily did not, to the best of our belief, injuriously affect the patients. On the contrary, they were, as a rule, much refreshed by getting into clean surroundings and clean bedding. Sheets were, as far as possible, changed at every move; mattresses, blankets, waterproof sheets, were exposed to the air in the intervals. There were, of course, no bedsteads, patients sleeping on mattresses on the ground.

About fifty yards away from the hospital we kept a small rough incinerator going. All choleraic discharges were mixed with bhoosa (chopped straw) and burnt there. The sweeper had a supply of phenyl for his own hands. Close to the tents were basins of antiseptics, and all

the orderlies and ward servants had strict instructions to wash their hands thoroughly in the solution after every handling of a patient. The orderlies had a camp about fifty yards away, and the ward servants another in a different direction, and all were strictly forbidden to take any food or drink in the hospital. As a result of these measures we may claim that not a single one of the native establishment contracted the disease, and but one of the orderlies. In his case, too, the cause was not far to seek. We have it fairly well authenticated from his comrades that he was seen to put some ice into his mouth with unwashed hands immediately after attending to a patient. In fact, the conclusion we may come to is that when proper precautions are taken cholera is not more infectious than typhoid, but the precautions must be unceasing, and no loophole left through carelessness or neglect.

Lecture.

THE COLLECTION AND TREATMENT OF WOUNDED CAVALRY SOLDIERS.[1]

By Lieutenant-Colonel W. G. MACPHERSON, C.M.G.
Royal Army Medical Corps.

Introductory Remarks.

A short time ago I read a remark of an Austrian cavalry officer, of much experience, which struck me as being true to a great extent of the medical aid available when a cavalry soldier gets wounded. It was this, "*Was ich als Kavallerist im Felde nicht habe, das habe ich nicht.*" The remark draws attention to the difficulties that are involved in the collection and treatment of wounded cavalry soldiers.

These difficulties are due mainly to two causes; first, the greater mobility of cavalry and the distances covered by it, and, second, the frequent use of cavalry on reconnaissance duties in isolated and more or less independent detachments.

Cavalry to be mobile must have as few impedimenta as possible, and this fact tends to reduce the medical *personnel* and equipment to a minimum, and to add, therefore, to the difficulties of the medical arrangements.

As regards the distances traversed by cavalry, these affect the medical arrangements chiefly because of the difficulty of keeping a regimental medical service and cavalry field ambulances in touch with units, brigades

[1] Lecture delivered at the Cavalry School, Netheravon, September 21st, 1908.

or divisions. There is no great difficulty so long as there are no wounded; but, when wounded have to be attended to, the medical *personnel* and equipment may be left far behind and may have great difficulty in finding their way back to their units.

The use of cavalry in isolated and small parties, spread over many miles of country, presents difficulties in the matter of the time that must elapse before medical aid can be obtained, in sending back messages concerning men who become wounded, and in bringing them in from outlying posts, probably over difficult country. Wheeled transport, unless in the form of a bicycle stretcher, to which reference will be made later on, cannot, as a rule, accompany patrols or scouts; and, except by hand carriage or by carriage on the back of the wounded man's horse, there is little else available in the way of transport.

There are thus many points which place the wounded cavalry soldier in the field at a disadvantage as compared with the infantry soldier, so far as medical aid is concerned.

On the other hand, the mass of wounded that has to be dealt with in the case of cavalry is comparatively small, although one must not forget, in this connection, that the total number of wounded, while giving a low percentage for the whole campaign, may have been concentrated into one or two sharp engagements, and that the mass of wounded to be dealt with at one time may thus have been considerable. The concentration of wounded in mass should, however, facilitate rather than add to the difficulties of dealing with the wounded cavalry soldier, because, after an engagement producing a mass of wounded, several medical units are likely to be on the spot or near it, and their collection and evacuation would then be carried out on a larger, more detailed and systematic plan than is possible in dealing with casual wounded of detached troops.

Medical Services with Cavalry.

Keeping these preliminary observations in mind, as presenting the difficulties which must be taken into consideration in the handling and use of a medical service with cavalry, let me describe briefly the field medical arrangements for cavalry in the British army.

These arrangements are in two *échelons* or lines of assistance; the first, the regimental medical service, and the second, the cavalry field ambulances.

The regimental medical service consists of a medical officer with each regiment, one corporal and two men of the Royal Army Medical Corps, nominally in charge of the water-cart, but available for assisting the medical officer generally, and eight privates of the regiment trained in sanitation and placed under the immediate orders of the medical officer. Four bandsmen in each squadron or twelve men in the regiment are trained in first-aid as stretcher-bearers, but the means of utilising them when in contact with the enemy is not definitely laid down. One lance-

corporal and one private of the regiment are appointed as orderlies to the medical officer, the one to attend and assist him in his duties, and the other to act as driver of the Maltese cart carrying the medical equipment. The medical equipment consists of a first field dressing, carried by every officer and man, a pair of field medical panniers, a medical companion, a surgical haversack, and three stretchers carried in the Maltese cart. A pair of surgical saddle-bags is carried on the saddle of the horse ridden by the medical officer's lance-corporal orderly. It is not my province to discuss with you the uses and distribution of this material, but this enumeration of the various cases or packages gives you some idea of what resources each cavalry regiment has with it for the immediate treatment of its sick and wounded.

The cavalry field ambulance is composed of officers, warrant-officers, N.C.O.'s and men, some of whom are utilised in performing the duties of stretcher-bearers, of a bearer division as it is called, and some in performing hospital duties, that is to say, the duties of a tent division. They have a medical and surgical equipment for first-aid and treatment, and stretchers, light ambulance wagons, and heavy ambulance wagons for the transport of sick and wounded. The actual details of this unit are 6 officers and 70 other ranks of the Royal Army Medical Corps, 44 drivers and bâtmen of the Army Service Corps, 9 riding, 66 draught horses, 2 water-carts, 2 forage-carts (or limbered wagons), 2 general service wagons, 4 light and 6 heavy ambulance wagons. The *personnel* forming the bearer division, consists of 2 officers, 38 rank and file and 2 buglers; the remainder of the establishment forms the tent division. The bearer division collects and brings in wounded, the tent division receives them, affords them temporary treatment, and evacuates them to the more stationary medical units. Each cavalry field ambulance is further divisible into two identical sections—sections A and B, each section containing one half of the bearer division, *i.e.*, a bearer sub-division; one half of the tent division, *i.e.*, a tent sub-division; and one half of the equipment and transport material. Four cavalry field ambulances are attached to a cavalry division and one to each mounted infantry brigade. In practice there is thus one ambulance to each brigade.[1]

Points to be considered in the Method of Handling the Cavalry Medical Service.

In the method of handling the regimental medical service and the cavalry field ambulances for the collection and treatment of wounded, a variety of points must be considered.

In the first instance, wounded must be classified into at least three categories: (1) Those that are able to walk or ride without help; (2) those

[1] It is well to bear in mind that when the word ambulance is used, the medical unit and not the wagon is meant.

that require help and special means of transport; and (3) those that are best left alone—those, in other words, whom it would be difficult and dangerous to attempt to carry off the field, and whose best chances of recovery rest in their being made as comfortable as possible where they lie. In war in countries that are barbarous or when the Geneva Convention is not accepted or understood, the last category must be omitted except on occasions when the wounded would not be likely to fall into the hands of the enemy by being left on the field. Other points that must affect the methods of handling the medical services with cavalry are the nature of the operations on which cavalry is employed. Thus the operations of independent or strategical cavalry present more difficult problems for the medical service than do those of protective or divisional cavalry, because the latter are more closely in touch with the slowly moving infantry and the more permanent medical posts on lines of communication, and the distances over which wounded have to be carried before they can be properly housed and treated are consequently likely to be less.

Patrolling and scouting work, cavalry combats, general engagements, pursuits and raids have each their own special medical problems, and one can only indicate here the principles upon which they must be worked out.

Necessity of Training Cavalrymen in First-aid and in the Transmission of Messages regarding Wounded.

Bearing in mind, then, that there are two lines of medical assistance—the regimental medical service and the cavalry field ambulances—the functions of the regimental medical service relative to wounded is to afford first-aid and bring the patient back to the ambulance. Now both of these functions are functions which cavalrymen as a class should understand and know more about than other soldiers. According to the regulations only four men in each squadron need to be trained in first-aid, but as many as like may volunteer for a course of training. In my opinion every cavalryman should have some knowledge of first-aid and of methods of carrying wounded. He should therefore volunteer for this course. I do not mean that he should have a wide or deep knowledge, but he ought to know generally what to do with the first field-dressing and, what is of equal importance, what not to do. He ought to know and appreciate, for example, the necessity of not handling a wound, in order to examine it or pick particles out of it, of avoiding all attempts to clean it up, and so on. These are examples of what he ought not to do; but he should also be taught how to cover the wound with the material in the field-dressing and how to apply a bandage over it. His training should also enable him to recognise serious bleeding, to distinguish it from less serious bleeding, and how to stop it; to tell when a limb is broken and

to improvise some method of fixing it before any attempt is made to carry the sufferer back. The value of this kind of knowledge on patrolling and scouting duties is self-evident. The officer in charge of reconnoitring detachments or patrols is, indeed, in much the same position as the captain of a vessel that has no medical officer on board. He has, for the time being, to be his own doctor, and some skill in temporarily attending to any man who gets wounded will be a useful addition to his knowledge. I lay special stress on this point, because you will find that considerable time must elapse before a medical officer, or trained man of the medical corps, can come up when a man is wounded on reconnoitring work; and the comfort and advantage of having a first field-dressing or support to a broken limb suitably applied are great. Every cavalryman ought, therefore, to know what to do for himself or for his comrade, in the event of either getting wounded.

Let us suppose, then, that the wounded man has had a first field-dressing applied, bleeding controlled, broken limbs fixed or supported, what measures are to be taken subsequently for getting him to the ambulance? Several courses are open. If the man is able to look after himself he should find his own way back. For example, a wound of one arm, though severe, need not incapacitate a man from finding his way back, either on foot or horseback. In fact, I know of one Russian cavalryman who was shot through the lung at the Battle of Mukden, and rode back 17 miles unaided. In such cases the man must be directed to go back by himself to his detachment or contact troop or squadron. He may, at the same time, be employed in bringing back information. In any case, he should follow the line of transmission of information until he comes into touch with the regimental medical *personnel*. It is useful to fix in orders some central point, such as a well-known village or feature of the country, to which wounded men, who are able to find their way back alone, should proceed; and the regimental medical service should have some of its *personnel* and equipment there; or, still better, a medical post should be formed by a detachment from a cavalry field ambulance, which in preliminary reconnaissance will have little or nothing to do, and can be usefully employed in forming these advanced medical posts.

In the case of men who are more severely wounded, other measures must be taken, and the chief concern then will be to send information back and arrange means of transport.

As regards transport of wounded, cavalry patrols are in very much the same position as troops operating in mountainous country; that is to say, the wounded may have to be carried over difficult and rough ground before a good road for wheeled transport is reached. In this case, a suitable point should be selected on the nearest road to which wheeled transport can come up, and information sent back as early as possible to the medical officer to enable him to send an ambulance wagon to the place selected. The man must then, if he is in a fit

condition to be moved, be taken to some spot where he can be found by the medical officer or the stretcher-bearers working under his direction. Attempts should not be made to carry him too far, but if possible he should be placed in a sheltered spot or building close to the road. The message sent back must include not only the exact description of where the man is to be found, but also the nature of his wound and what has been done for him. In describing the wound, the information need not go further than to state the nature of the weapon or missile causing it, the part of the body hit (*i.e.*, face, neck, chest, abdomen, hip, shoulder, upper arm, forearm, hand, thigh, leg, foot), and whether bones of a limb are fractured or not. General remarks as to the condition of the patient are valuable, such as whether he is suffering from shock, *i.e.*, collapsed and unconscious, or able to attend to himself and give directions about himself. A rough sketch to indicate the spot where he lies should be added. A useful suggestion is that patrols should have with them light sticks with some distinctive flag, which can be planted in the ground or fixed to some prominent feature, in order to indicate where a wounded man has been left. This method was used occasionally in South Africa.

In a course of first-aid to cavalrymen practical instruction and exercises in transmitting information of this kind should be given; and during manœuvres it would seem easy and useful to practise sending back such messages.

Method of using the Medical Personnel with Cavalry Regiments.

Rôle of the Regimental Medical Officer.—We have so far dealt with the wounded man during the period that must elapse before he gets skilled medical aid. His first field-dressing is applied, he is made as comfortable as possible, and information is sent back concerning him.

The next consideration is how the medical officer and stretcher-bearers of the regiment are to act. Their distribution in the regiment is here a matter of importance. In dealing with reconnoitring detachments and patrols it is not possible to have the medical officer anywhere near the spot where a man is likely to be hit. His proper place would be with the officer commanding the regiment, and, in my opinion, the squadron stretcher-bearers should be grouped beside him. There is, however, nothing laid down on the point. It is open to discussion, and I venture to give it as the best distribution of the *personnel* for medical services when cavalry is engaged in reconnaissance work, because the medical officer is likely to get the information regarding casual wounded most readily by being with the officer who receives the message in the first instance, and because by having all the stretcher-bearers with him he can, on receipt of information, detail the men required to bring a wounded man in and give them direct instructions. I do not think it advisable or necessary for the medical officer to gallop off to every wounded man. If he

did so he might be spending several hours going and coming from one case and tiring out his horse, only to find on his return that other cases had been calling for him in different directions in the meantime. It is better, therefore, for him to remain where he gets information most readily, and where he can direct the work of the stretcher-bearers sent to the wounded. Of course, he would judge by the nature of the information he receives, what cases required his immediate attention; but he would not, for example, require to go out to a man with simple wounds in the arm or leg, although he might think it advisable to supervise personally the bringing in of a more complicated and serious injury, and to visit as early as possible those whom he might wish to avoid moving until he had personally seen them.

Rôle of the Regimental Stretcher-bearers.—As regards the collecting and bringing in of wounded by the stretcher-bearers one is faced with problems of considerable difficulty. How are you to carry the wounded? Where are you to leave them? These are questions that are asked.

According to the British regulations the only provision made in the regimental medical service for carrying wounded of cavalry is one field stretcher per squadron and four stretcher-bearers per squadron. The field-stretcher is the regulation field-stretcher, which is not adapted for carriage on horseback, and the three squadron stretchers are consequently carried in the regimental medical cart. In order to bring a stretcher to a wounded man, the stretcher-bearers would have to dismount and practically cover the distance on foot. For the relief, therefore, of casual wounded on patrol or scouting duties, the stretcher-bearers must ride to the wounded without stretchers or transfer the stretchers to a light ambulance wagon borrowed from a cavalry field ambulance, a point to which reference will be made later on.

Methods of Carrying Wounded Cavalry.

But apart from regulation methods of transport, many improvised and other methods have been invented to enable wounded cavalrymen to be brought back to the neighbourhood of the ambulances. A description of these methods would fill a volume of considerable size, and I can only enumerate here the chief varieties and their relative values :—

(1) *Carriage on Horseback.*—There are several methods of carrying wounded on horseback. The man may be supported sitting astride the saddle, or he may be carried in litters or cacolets placed one on each side of the saddle, or he may be carried on a litter placed across the saddle. For carrying wounded on the saddle, Colonel Hathaway has invented a form of crutch or cradle, which can be fixed to the saddle and which will prevent the wounded man from being unseated if he is otherwise able to sit up astride. Colonel Hathaway considers that a certain number of these crutches should be carried with a cavalry regiment into

the field, and that saddles should be constructed with holes or slots into which the uprights of the crutch can be screwed or fixed when required.

The use of litters and cacolets, both of which are still employed in some Continental armies, requires a pack-saddle, but some means of improvising litters have been devised, chiefly by the American officers, using only articles of equipment of the wounded man or of his horse or such other material as would be at hand. It is, perhaps, easier to improvise methods of carrying wounded across the saddle than to improvise side litters. Where sacks, boxes, or similar articles, such as baskets, can be obtained, they can be filled with earth, straw, and stones to pack and weight them, and a pair fixed one to either side of the saddle. Then a board, such as a shutter, or the field stretcher if available, or failing these a good layer of straw or grass and the great-coat or a blanket should be placed across the saddle so as to rest on these improvised panniers and fixed by rope, cord, or straps. This makes a litter upon which the wounded can lie across the saddle and be strapped on. It is by far the most comfortable position for a wounded man that has to be carried lying down on horseback. It is a method which I have personally tested and found more free than any other from jolting or uncomfortable motion. It is specially adapted for use on a pack animal carrying side-loads, and is the method adopted by the Arab tribes for carrying their sick.

But there is another ready method of getting wounded away which is of special value in the case of cavalry, namely, the *travois*. A couple of long poles, such as can be obtained by cutting down young trees or larger branches, are fixed one to either side of the saddle with the free ends trailing on the ground. A blanket, great-coat, or other suitable material is tied on between the poles to form the body of the *travois* and the wounded man is placed on this and dragged away. By cutting one of the poles about $1\frac{1}{2}$ feet shorter than the other unevenness in the ground is not felt. *Travois* are specially constructed for use with the United States Cavalry, and they are so easily improvised and so suitable for getting a wounded cavalryman back from fields, &c., to the road, that they may be considered the best method of removing wounded by means of the cavalryman's horse. The *travois* may also be used with two horses to form a litter similar to the horse-litters used in China, and to some extent by the Russians in Manchuria. The free ends of the poles, instead of being allowed to trail on the ground, are fixed to the saddle of a second horse, so that the patient is carried on a litter between two horses moving one behind the other.

(2) *Carriage by Bicycle-stretchers.*— The bicycle-stretcher has not been taken up much in our Army, but on the Continent, especially in Austria, it is regarded with much favour. Ordinary bicycles may be used and stretchers fixed to them by various improvised methods. Many varieties of bicycles are also made with parts that can be dismounted so as to bring the wheels parallel to one another, and allow of stretcher-

poles and canvas being rigged up between the wheels to form a wheeled litter. These bicycles, with their riders carrying the poles and canvas, can accompany cavalry wherever there is good road communication, and, in my opinion, they are the best equipment for the squadron stretcher-bearers to have. They are much more handy for carriage of wounded than horses or the regulation stretcher, and the rapidity with which the wounded man can be reached by bicycle-riders is great. Their movements can also be more easily concealed. Wounded can be carried back rapidly when a stretcher or litter is rigged up between two ordinary bicycles, for the cyclists can then ride their bicycles and bring the wounded back at any speed they find most suitable for the patient or themselves.

(3) *Improvised Stretchers*—that is to say, any form of stretcher that can be put together out of local material—will not be of much use to cavalry, because of the time taken to improvise and carry wounded back by stretchers, and the difficulty of having sufficient bearers at hand for the purpose. In some armies, as is mentioned, for example, in the German field medical regulations, it is thought that many auxiliary bearers may be obtained from amongst men who have been unhorsed, have lost their horses, or had their horses shot; but, according to the statistics of several cavalry engagements, the number of horses injured has not been so great as that of men, so that no reliance can be placed on obtaining auxiliary bearers in this way.

(4) *By Wheeled Carriage.*—In the Royal Army Medical Corps training manual it is laid down that the light ambulance wagons of the calvary field ambulance should be detailed to accompany cavalry regiments or squadrons acting independently. The Medical Officer of a cavalry regiment would thus have at his disposal one of these wagons, and on his receiving a message from a reconnoitring detachment or patrol would be in a position to detail the wagon to go forward to the spot indicated in the message. A wagon orderly of the Royal Army Medical Corps would be with the wagon, and squadron stretcher-bearers and stretcher would be sent on with it. Its objective would be the nearest spot on the road to the place indicated in the message. If the wounded man has been left in some spot not actually by the roadside, the stretcher party would be available for the purpose of bringing him to the wagon.

This method of collecting the wounded is, of course, of all methods the best for the wounded man himself. It would work well when there is no objection to a wheeled vehicle being sent forward, and where only two or three casual wounded have to be dealt with; but when wounded are more scattered over a wide area, and where concealment of movement is desired, it would probably be found necessary to use one or other of the improvised methods mentioned above.

Places to which Wounded are to be Sent.

The point to which wounded men are to be brought by the regimental medical service has next to be determined. The first principle to attend to is the necessity of keeping in touch with a cavalry field ambulance. In conjunction with the officer commanding the ambulance, some spot must then be selected to which the regimental medical service brings the wounded, and at which the ambulance takes them over. This position is not necessarily a fixed spot, but it may move forward or backward in conformity with the movements of the cavalry brigade to which the cavalry field ambulance is attached; the points that are essential being the touch that must be maintained between the first and second line of medical aid, and the necessity of keeping each regimental medical officer informed of the exact position of the spot that is selected from time to time. For example, the calvary field ambulance of the brigade forms a collecting station at A during the night of September 9th-10th. At 8 a.m. on the 10th it is advanced 5 miles to B, it being timed to arrive there at 9 a.m. At 10 a.m. it is advanced to C, to arrive there at 11 a.m., and so on. The information should be at once signalled or otherwise conveyed to all regiments of the brigade. It would then be the duty of the regimental medical service to which the light ambulance wagons are attached to bring the wounded to the collecting station at the spot indicated. When the collecting station, in order to conform with rapid advances of cavalry, is also advanced rapidly from one point to another, it may happen that information regarding the change of place may not have reached a unit before its wounded are sent back. If there is any doubt on this point, a detachment of the cavalry field ambulance should be left for a time at the previous point. In other words, there should be a relay, so to speak, of collecting stations.

Wounded of Strategical Patrols.

So far these principles affect the arrangements for collection and treatment of men of independent or protective cavalry, who may be casually wounded during the service of reconnaissance requiring dispersion. They are, however, inapplicable in the case of strategical patrols, when the latter have got behind the enemy's cavalry screen, or during cavalry raids. In these cases only two courses are open. Sick, wounded, or injured men must then either be carried on with the detachments, or they must be left in the nearest villages to the care of the inhabitants, unless the distance does not prevent a man who is able to look after himself finding his own way back to his army. In the Japanese cavalry raid during the Manchurian campaign, men who became unfit to proceed were left in the Chinese villages, and picked up again when the raiding party returned. The strategical patrols described in the opening chapters of "Die Schlacht der Zukunft," a German work published last year, had one or two

wounded at the very commencement. They were ordered either to go back as best they could to their own army, or find their way to the nearest village, which was, of course, in hostile territory. In the latter case the wounded man was given a note, signed by the officer commanding the party, calling on the inhabitants to take care of the patient under threat of having their village burned should it fall into possession of the army to which the wounded man belonged, and the man be found to have been badly treated.

Method of using the Regimental Medical Service during Concentration for Attack.

When cavalry is concentrated for attack, the regimental medical arrangements must be of a totally different character. Light ambulance wagons are no longer distributed to regiments, and although it is a principle which is not laid down so far as I know anywhere, the regimental medical *personnel* and squadron stretcher-bearers should be withdrawn from the regiment and grouped behind the brigade. No possible advantage can arise from this *personnel* charging in the combat, while it can be of immense use immediately afterwards in deploying over the area where the attack has taken place and affording first-aid to, and collecting, the wounded. It is under these conditions that the squadron stretcher-bearers and field-stretchers can best carry out their *rôle* of dismounted stretcher-bearers, and bring wounded to a selected spot where they may be kept temporarily under cover until the bearer division of the cavalry field ambulance comes up. Immediately the bearer division of the cavalry field ambulance reaches the area of combat, the *personnel* and equipment of the regimental medical service should rejoin their units as rapidly as possible. Cavalry will probably be in pursuit, and there will be much then for the regimental service to attend to in the way of affording first-aid, leaving wounded at fixed spots under cover, and sending information back to the ambulance indicating where such wounded are to be found. In the event of the hostile cavalry proving successful, the regimental medical *personnel* may place reliance on the Geneva Convention and go out to succour wounded left on the field, or they may retire with the remnants of their unit, leaving the wounded to the care of the enemy. But a middle course may be followed that is quite in keeping with the spirit of the Geneva Convention, namely, to leave a portion of the medical *personnel* with the wounded and order the rest to return with their unit. But in this respect we are considerably handicapped as compared with Continental armies, which have more than one medical officer and a larger medical *personnel* attached to combatant units than has the British Army.

The Method of using the Cavalry Field Ambulance.

We come now to the method of using the cavalry field ambulance. In practice one cavalry field ambulance would be told off to conform

with the movements of a brigade, when in presence of the enemy. At other times the four ambulances of a cavalry division are grouped behind the division. The *role* in any case of the cavalry field ambulance is a difficult one. Not only must it provide for the reception, care, and treatment of the wounded sent to it by the regimental medical service during reconnaissance work, but it must keep in touch with rapidly advancing cavalry on the one hand and evacuate wounded to its line of communication on the other. For touch with the regimental service, as has already been noted, there are the light ambulance wagons, which will move along the roads in the direction of the reconnaissance objective, under the orders of the regimental medical officers to whom they are lent, and will bring back wounded to the collecting posts established from place to place by the cavalry field ambulance as the brigade or division advances. The six-horsed heavy ambulance wagons will be brought up to these collecting posts. They are specially constructed not only to act as means of transport for wounded, but also to serve as a temporary shelter. In fact, the interior of the heavy ambulance wagon becomes for the time being a four-bedded ward; so that each brigade has accompanying it a small hospital on wheels, of twenty-four beds, for serious cases of wounds. The advantage of this is great, because wounded can thus be taken on with the cavalry division from one objective to another, until opportunities occur for sending them back to the line of communication. These opportunities occur whenever supplies come up or when country carts, &c., can be obtained. Wagons or other vehicles bringing up supplies to the cavalry brigade or cavalry division should always be utilized to empty the ambulance and bring back the wounded to points where they can be taken over by a clearing hospital; or, as would more probably suggest itself, to the medical units of the main force which the cavalry is covering, and through them to the clearing hospitals. The necessity of cavalry field ambulances keeping in touch with field ambulances of divisions is therefore of much importance, especially in the case of protective cavalry, and this touch should be maintained by constant and careful transmission of information on the part of both.

But the chief work of the cavalry field ambulances occurs when a cavalry combat is imminent or has taken place. The ambulances should then be concentrated with all their transport material as near the probable area of combat as possible, and be prepared whenever the attack has been launched to push forward their bearer divisions to the area over which the combat has taken place, and thus set the regimental medical service free. For purpose of concealment of cavalry movements it may not be advisable to concentrate the ambulances nearer the combat area, let us say, than 5 miles, but when the order is received the bearers would be sent forward as rapidly as possible with the stretchers in the light ambulance wagons, and might be expected to

arrive within an hour after the attack. The tent division should follow to the nearest convenient spot for making preparations for the reception, accommodation, temporary care and treatment of the wounded men, its final duty being to evacuate to the line of communication.

A point, however, for the commanders of brigades or of a cavalry division, who issue the orders for the movements of cavalry field ambulances, to remember, is the necessity of keeping a section of an ambulance or a whole ambulance ready to follow up any portion of the troops sent in pursuit. This can be done after a combat by ordering one of the ambulances to hand over its wounded to another, or by ordering it to remain in reserve ready to follow up when orders are received to that effect.

Use of Medical Service in Cavalry Dismounted Action.

When cavalry are engaged in dismounted action the same principles and methods of handling the regimental medical services and ambulances apply, with this exception, that in dismounted action the regimental medical service should be with its unit and go into action with it, affording first aid to men as they fall and placing them as far as possible under temporary cover until the ambulance bearers come up, instead of waiting, as in a cavalry combat, until the *mêlée* is over.

Summary.

In reviewing generally the best method of collecting and treating wounded cavalry soldiers the following is a summary of the points which should be borne in mind:—

(1) All cavalrymen should make a point of understanding the principles of first-aid and the application of the first field dressing.

(2) Methods of improvising means of carrying a wounded man on horseback out of the horse equipment and material at hand should be practised; such methods, for example, as the use of *travois* and improvisation of horse litters from saddle and other equipment.

(3) Cavalry patrols should learn the kind of information required to enable the medical officer of a regiment to use his resources to the best advantage without overtiring either himself or his horse, and should practise the transmission of messages regarding wounded.

(4) The regimental medical service has its most important *role* with protective cavalry and before independent cavalry is concentrated for a cavalry combat. In other words, its chief *role* is in connection with casual wounds, or men wounded in detached parties. To help it, light ambulance wagons should be distributed amongst regiments from the cavalry field ambulance.

(5) When cavalry concentrate before a cavalry combat the regimental medical *personnel* should be concentrated behind the brigades and only move to the area of the *mêlée* after it has taken place.

6) After the *mêlée* the regimental medical *personnel* should rejoin

their units in pursuit, immediately the bearer division of an ambulance arrives on the scene.

(7) In retreat the regimental medical *personnel* should retire with its unit, leaving a small proportion behind in charge of wounded on the field.

(8) The cavalry field ambulance has its most important *role* after a combat, or when wounds occur in concentrated time and space.

(9) Its duty during operations, involving dispersion, is to keep in touch with the regimental service by forming collecting posts, receiving, treating and carrying the casual wounded brought to these posts, and utilising the heavy ambulance wagons both as shelter and transport until opportunities occur for sending the wounded back to the lines of communication.

(10) Its duty during and after a cavalry combat is to send its bearer division at once to the area of combat, sending the ambulance wagons as far forward as possible; and to establish its tent division as near the scene of action as possible.

(11) Both regimental medical services and cavalry field ambulances must keep in touch with one another by constant and careful transmission of information.

(12) Cavalry field ambulances and field ambulances of divisions which are being covered must keep in touch with one another in a similar manner.

I have not dealt with the details necessary for carrying out these principles. They are details which must be worked out on the spot and by cavalry commanders in conjunction with the medical services. The principles, however, indicate how essential it is for a divisional cavalry commander to keep his administrative medical officer in touch with his intentions and movements and for brigade and regimental commanders to keep officers commanding cavalry field ambulances and medical officers attached to regiments similarly informed. Like everything else, the collection and treatment of wounded cavalry soldiers is a question of sound co-operation between the staff and administrative services, if these functions, with their somewhat difficult problems, are to be performed to the best interest of the soldier, who is wounded, and of his comrade, who has to fight.

Report.

SECOND REPORT OF THE COMMITTEE ON THE PHYSIOLOGICAL EFFECTS OF FOOD, TRAINING, AND CLOTHING ON THE SOLDIER.

On the Physiological Effects of Marching.

The capacity to march long distances without undue fatigue or distress is an essential qualification of a good soldier. Upon this point all authorities are agreed. Marching implies not only walking in step with other men, but the carrying of a load so arranged that the soldier always has his arms free for the use of his rifle, and can, if it be necessary, march at the double. These conditions make marching a much more severe exercise than ordinary walking. There are also other adverse factors, such as marching in the ranks and in clothing and equipment not especially adapted for muscular work. It is necessary, therefore, to study the physiological effects of marching in relation to load and clothing, and to determine how far the adverse conditions can be minimised, for in most cases they cannot be removed owing to the exigencies of warfare. In addition to these there are external conditions which are beyond control; the most important of these are temperature, moisture, wind, dust, and the nature of the country traversed.

It is recognised that fatigue or distress during marching diminishes the fighting capacity of the soldier, even apart from any subsequent impairment of his physique; a soldier directly after a trying march is unable to shoot well, for there is constantly seen under such conditions a trembling movement of the hands which cannot readily be controlled. The causes of this inco-ordination are unknown and require investigation.

The physiology of marching has not been the subject of many experiments, and in order to obtain reliable data a series of observations have been carried out as part of the work of the Committee. Experiments were made upon soldiers of the Royal Army Medical Corps, 1st Battalion Yorkshire Regiment, 1st Battalion Irish Fusiliers, and *Spectator* Experimental Company at Aldershot, and also upon ex-volunteers in the Physiological Laboratory of Guy's Hospital. More stress is laid upon the former series, for in the laboratory it is impossible to make the conditions similar to those under which the soldier works. At Aldershot the marching was carried out on the country roads, and as far as possible under the ordinary regulations for dress, pace, and halts. In order that the observations might be more complete, one member of the Committee joined in the marching of the men of the 1st Battalion Yorkshire Regiment and 1st Battalion Irish Fusiliers, under conditions of clothing and equipment

similar to those of the private soldier. The observations included the determination of the weight of the men, the weight of the clothes and equipment, the pulse, the blood-pressure, the rectal temperature, and the surface temperature of the face, wrist, and cheek, before and after marching.

The marches were performed in summer, winter, and spring, in order that the influence of external conditions, such as temperature and moisture, might be determined.

It will be unnecessary to give here the data of the numerous observations, which number several hundreds; typical examples are given in the Appendix to this report.

The experiments were made in several series, and the results can most readily be arranged under the following headings:—

(1) Individual variations in the temperature and pulse of soldiers at rest.

(2) Individual variations in the temperature and pulse of soldiers after marching.

(3) Influence of marching without any load upon the temperature, loss of moisture, and pulse.

(4) Influence of marching with different loads upon the temperature, loss of moisture, and pulse.

(5) Influence of marching with similar loads, but under different conditions of external temperature, moisture, and wind.

(6) Influence of marching in different clothing.

(7) Influence of practice upon the effects produced by marching.

(8) Influence of smoking upon the effects produced by marching.

(9) Influence of drinking upon the effects produced by marching.

(10) Influence of halts upon the rapidity of recovery from the effects of marching.

In addition, the Committee made observations upon Regulars and Volunteers during manœuvres at Salisbury Plain and Chichester during the summer of 1906.

In the first place, the Committee consider it necessary to point out that in any investigation upon the influence of marching upon the soldier, it is imperative to recognise the extent of the individual differences which are present in the temperature and pulse of healthy men even during rest. One healthy man may have a pulse and temperature which would be abnormal in another man; there is a marked personal equation, and it is unsafe to define so-called normal pulse-rates and temperatures too rigidly. This applies with equal force to the conditions after marching.

One of the most important results of the experiments is the conclusive proof that the temperature of the body is raised considerably by marching. This has not been generally recognised, and is an important factor in the causation of heatstroke, and the minor condition of exhaustion which causes men to fall out on the line of march. A rise of internal tem-

perature to a certain extent during muscular work is normal and probably advantageous, but if the external conditions, such as temperature and moisture, are unfavourable for the loss of heat, this physiological rise of temperature may be exceeded, and detrimental and even fatal effects follow. No abnormal results were observed when the rectal temperature of some of the men reached 102° F., but above that point inefficiency and a rapid and irregular pulse were observed. The conditions which determine the rise of temperature during a march are chiefly the temperature and the moisture of the air, and the effectiveness of the evaporation of sweat from the clothes and body of the soldier; in the next place should be mentioned the influence of practice in marching and the carrying of a load. As an example of the importance of sweating an experiment may be given. Five men during a march of 7 miles in drill order lost by evaporation an average of over 3 pints of water (1,816 grammes), the maximum loss being over 4 pints (2,390 grammes) and the minimum over 2 pints (1,200 grammes). Notwithstanding the loss by evaporation, their clothes were damp, the greatest gain of moisture being about 1 pint (640 grammes), the minimum about 2 ounces (60 grammes), and the average about ½ pint (320 grammes). It was a hot day in September, when the temperature of the air by the dry and wet bulb thermometers was 79° and 67° F. respectively, and there was at times a south-west breeze. The evaporation of sweat is the chief way in which a man cools his body when he gets hot. For this to be effective there must be free contact with the air. The evaporation depends upon the difference between the temperature and moisture of the man's skin and clothes and the temperature and moisture of the external air. The condition of the external air is largely beyond control, but it is possible to favour the evaporation from the clothes and body by opening the jacket and allowing the moisture to escape.

A civilian takes off his coat, turns up his shirt-sleeves, and opens his shirt at the neck when he is working on a hot day. The custom in the army appears to be the exact opposite; the soldier marches with his jacket buttoned up to the neck and confined by a belt and by straps across the chest, and only takes off his coat and opens his shirt when he reaches camp and his hard work is over. The reason for this appears to be unnecessary regard for appearances or smartness on the line of march. The practical result is inefficiency. The soldier is made to sweat for a given amount of work more than is necessary. Perfectly free evaporation can only proceed from the jacket after the shirt has been soaked. The cooling effect is thus delayed, so that the temperature of the body in the meanwhile rises; great discomfort is caused, and a much larger quantity of moisture must be lost to produce a given cooling effect than would be required if the evaporation proceeded directly from the opened shirt and partly exposed skin. A healthy body maintains its percentage of water at a very constant level, and the soldier must replace

any excessive loss. The loss of moisture produces a thirst which must be and is satisfied, and unfortunately not always from the most suitable source.

Experiments confirmed the conclusions drawn from everyday experience; the free exposure of the shirt saved the body a loss of about a pint of water during a march of 7 miles in two hours. It is recognised that a soldier on active service must wear a jacket and carry a great-coat, but there is no reason why the jacket should not be opened if necessary, for there is no danger of a man catching cold when he is actively at work.

Further experiments showed that on a hot summer's day a march produced on soldiers in drill order as great an effect as a similar march in full marching order with 100 rounds of ammunition on a cool winter's day. The chief adverse factors to marching are a high temperature, moist air, and an absence of wind; these are conditions which delay the evaporation of sweat. A high temperature can be borne if the air is dry and in motion, for evaporation is favoured by such conditions.

Load is another important factor, but all the observations show that its effect is subordinate to the external conditions of temperature, moisture, and wind. By frequent practice a man may develop his capacity to carry loads, but he can only raise to a limited extent his power of resisting the effects of a hot, moist, and stagnant air. A soldier must carry a load, and for this reason it is of the utmost importance that the loss of heat from his body on a hot day should be facilitated by the opening of his jacket and shirt, so that the sweat may readily evaporate.

Another point upon which the experiments throw light is the influence of practice upon the effects produced by marching. They show that after three weeks practice a trained soldier in full marching order can march the same distance over the same road with less fatigue than that produced when he performed the first march of the series in ordinary dress. This beneficial influence of practice upon the untrained member of the Committee who joined in the marches was even more marked. The influence of practice upon the performance of muscular work is well recognised. A soldier learns to march efficiently only by marching frequently; he learns thereby how to accommodate himself to the demands of muscular work, and to carry his load with the minimum of exertion. The benefits of practice are obtained most readily by training of a progressive nature, both as regards equipment and distance.

The effects of a halt were also investigated, and it was found that on ordinary days ten minutes after a march of $3\frac{1}{2}$ miles in one hour were sufficient; after the next hour's march at the same rate and over the same road a longer time, about twenty minutes, was generally necessary for a similar decline in the pulse-rate. On a hot, damp day, with little wind, a longer halt in each case would be necessary. In fact, the duration of the halt should depend upon the nature of the adverse conditions,

such as temperature, moisture, absence of wind, load, want of practice, and rate of march.

All light infantry and rifles march with a quick, short step; it is doubtful if this be economical in a physiological sense, and it is certain that it is opposed to efficient co-operation with men who have been trained to march at the ordinary pace.

Smoking cigarettes during the march appeared to diminish the efficiency of the men; the rate of the pulse was raised to a greater extent than normal in nearly every case, although the conditions as regards the length of the march, equipment, and weather were as far as possible the same. Moreover, in some cases trembling of the hands was observed.

Drinking water before the march did not produce any definite effect, but the experiments have not yet been performed on hot days, and there is no doubt but that on a long day's march in hot weather the body must be supplied with water to replace the large quantity lost by sweating.

The Committee wish to make the following recommendations:—

(1) That it be an instruction to Officers Commanding that the order shall be given to men on the march in warm weather to open the jacket and shirt.

(2) That training in marching should, after the first fortnight of the recruit's enlistment, have the same value attached to it as physical training according to the terms of the manual on that subject, and that it should be a definite order that each young soldier should perform at least one march a week. The load carried and the distance traversed in these marches should be progressively graduated. These marches should not take place on the same day as physical training, and should be continued until the recruit is finally dismissed drill and physical training.

(3) That smoking in the ranks should be strongly discouraged.

It is the decided opinion of the Committee that there are two points of the utmost importance for securing the efficiency of the soldier in marching, and these apply especially to recruits and members of the Territorial Army. The first is that he *must* have frequent practice in progressive marching; with reference to this the Committee wish to lay the greatest stress on their recommendation (2). The next is that inefficiency and injury to health can be greatly lessened or abolished by allowing free evaporation of sweat to take place through the exposure of the shirt and skin. The Committee are convinced that if these recommendations are followed a great improvement in the condition of the soldier during and after long marches will be obtained.

In a subsequent report, the Committee propose to give the results of their observations upon equipment in relation to marching.

Minority Report.

By Colonel S. P. Rolt, Inspector of Gymnasia.

Whilst agreeing with the body of the report and with recommendations (1) and (3), I cannot agree with recommendation (2) in the "Second Report" of the Committee.

In the paragraph in question the relative position of physical training and marching does not appear to be fully appreciated. Both are equally important, and each has its proper place in the training of the soldier, as have also musketry, company training, digging, &c. The great point, however, that is so frequently overlooked and is not evident in the paragraph in question, is the fact that the place of physical training is—besides making the man fit for his work as a soldier in war and peace—to gradually bring him into such a state of physical fitness that he may be in a condition to derive the most benefit from his further and more arduous training in marching, manœuvre work, digging and other duties.

It has already been recognized by this Committee that a recruit, on joining, must first be fed and given time to settle down into the new conditions of his life, and that it will very probably take a fortnight to do this and to get over the effects of vaccination, &c. The Committee has also approved of the principle of gradual progression pervading the *whole* of his training, as well as his physical training, and has recognized the fact that his general training can hardly be expected to begin seriously until he has joined a fortnight.

The early days of this serious training contain, besides the time devoted to physical training, a considerable amount of drill (which includes, of course, marching), rifle exercises, musketry exercises, barrack routine, lectures, &c.; in fact, ample physical and mental work to keep the man fully engaged without the addition of route marching. After a few weeks, running training and skirmishing, which entail an increase in the actual physical work, are introduced, and, together with the physical training, are gradually increased in severity. A great feature in this gradual scheme of training is that the man is trained by means of physical and running training to habits of activity, besides gaining control and general physical development, and it is this *activity* that is so badly needed by the class of man from which our recruits are drawn. It is most unfortunate, but it is none the less true, that route marching tends rather the opposite way, *i.e.*, it tends to make the man slow, heavy, and dull, and if introduced into the general scheme of training before habits of activity, energy, and alertness are considerably developed, it is, I submit, more likely to do harm than good, and I, therefore, strongly protest against the recommendation to make "at least one march a week" compulsory during recruit training, or even recommended as advisable. The proper place for systematic training in marching is after the recruit is trained physically and is well advanced in his other

training. The true principles of progression are thereby much better fulfilled, and the result will, I am convinced, be that the soldier will be in the long run far better trained, a considerable amount of the recent "hustling" will be avoided, and the feeling of boredom occasioned by the monotony of constant marching will be saved. To be a good marcher is one of the most important qualifications of a foot-soldier, but it is not necessary that he should always be marching; a rest from this, as with other things, is beneficial, and it is inadvisable to commence this branch of training too soon.

By adopting this line the soldier can, I am confident, be trained to be a better marcher and a far more efficient soldier.

In place of recommendation (2) I recommend—

That the Infantry Training Manual should contain a section dealing with training in marching, putting the responsibility on Commanding Officers as with other training, and embodying the principle of gradual and easy progression as regards—

(1) Distances marched.

(2) Loads carried.

(3) Regulating the amount and commencement of the training in marching according to the physical development of the men.

(4) Considering the amount of such training with reference to manœuvres and other work.

APPENDIX.

IN THIS APPENDIX THE MORE IMPORTANT RESULTS OBTAINED DURING THE INVESTIGATION ARE GIVEN IN A CONDENSED FORM.

I.—Individual Variations in the Temperature and Pulse during Rest.

In any investigation upon the influence of marching upon the temperature and pulse, it is necessary to consider the individual variations which may be present during rest. The observations available for this purpose relate to six men of the Royal Army Medical Corps, four men of the 1st Battalion Yorkshire Regiment, four men of the 1st Battalion Irish Fusiliers, and Dr. Pembrey; fifteen men in all. The following table gives the chief results so arranged that the daily variation in the temperature and pulse may be taken into account.

Number of men	Number of observations	Number of days	Time of day	Pulse					Rectal Temperature				
				Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day	Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day
									degs. F.	degs. F.	degs. F.	degs. F.	degs. F.
6—R.A.M.C.	60	10	9—10 a.m. ..	110	55	93	68	80	100·2	98·6	99·9	98·9	99·3
3 of above	6	2	2—3 p.m. ..	100	77	99	85	92	99·4	98·6	99·1	98·7	98·9
4—1st Batt. Yorks.	4	1	10—11 a.m. ..	90	72	90	72	78	99·6	99·4	99·6	99·4	99·5
4—1st Batt. Yorks.	4	1	2—3 p.m. ..	100	90	100	90	93	100·1	99·4	100·1	99·4	99·8
4—1st Batt. Yorks. and M.S.P.	50	10	10.30—11.30 a.m.	92	68	87	72	80	100·3	98·8	100·0	99·6	99·6
3—1st Batt. Yorks. and M.S.P.	12	3	10.30—11.30 a.m.	88	60	83	68	75	100·3	98·8	100·1	99·2	99·6
4 Irish Fusiliers and M.S.P.	15	3	10—11 a.m. ..	104	60	99	65	78	100·4	99·2	100·2	99·4	99·8
4 Irish Fusiliers	20	5	10—11 a.m. ..	104	52	95	59	76	100·4	99·2	100·0	99·3	99·7
3 Irish Fusiliers	3	1	8—8.30 a.m. ..	88	76	88	76	82	101·0	00·2	101·0	100·2	100 5
15	174	36	..	110	52	93	71	81	101·0	98·6	100·1	99·4	99·7

These figures show that there were considerable individual differences in the rate of the pulse and rectal temperature, even when no active work had been performed before the observations were made. There is a marked personal equation and it is unsafe to define so-called normal pulse-rates and temperatures too rigidly. Some of the high figures for the pulse-rate may have been due to nervousness on the part of some of the men at the beginning of the series of observations.

II.—Individual Variations in the Temperature and Pulse after Marching.

The general effects of a march will be seen by a comparison of the averages of all the observations made upon men after a march with the corresponding data for the conditions of rest. The next table gives the results for all marches, irrespective of distance, external temperature, clothing, and load.

Number of men	Number of observations	Number of days	Pulse					Rectal Temperature				
			Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day	Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day
								degs. F.	degs. F.	degs. F.	degs. F.	degs. F.
6—R.A.M.C.	245	10	150	70	115	89	101	101·8	98·8	100·8	99·8	100·3
4—1st Battalion Yorks.	8	1	112	88	108	93	101	101·2	100·4	101·0	100·5	100·7
4 1st Battalion Yorks. and M.S.P.	50	10	160	72	123	100	112	102·4	99·2	101·4	100·2	100·8
3—1st Battalion Yorks. and M.S.P.	12	3	114	72	105	85	95	100·8	99·5	100·5	99·9	100·2
6—*Spectator* Company	6	1	120	93	120	93	106	102·0	100·0	102·0	100·0	101·1
4—Irish Fusiliers and M.S.P. ..	15	3	126	70	119	78	98	101·2	99·8	101·1	100·3	100·7
4—Irish Fusiliers	20	5	126	80	112	88	101	102·1	99·8	101·5	100·2	100·8
3—Irish Fusiliers	3	1	138	84	138	84	117	101·7	100·4	101·7	100·4	100·9
21	359	34	160	70	118	87	104	102·4	98·8	101·4	100·2	100·7

The above figures are certainly somewhat underestimated, for it was impossible to take all the observations immediately after the march; the pulse and temperature begin to fall directly the work is at an end. Precautions were taken to diminish the source of error; the men were directed to march up and down outside the hospital until they were wanted; but it was noted that they frequently walked slowly, or, in some cases, stood still or even sat down. The observations on the pulse and temperature of M.S.P., of one of the 1st Battalion Yorks., and of one of the 1st Battalion Irish Fusiliers were taken at once on each day, and the times of observation in the case of the other men were noted.

III.—Influence of Marching without any Load upon the Temperature, Loss of Moisture, and Pulse.

There are numerous data for the men of the Royal Army Medical Corps, but they will not be given here for the reason that the marches were of different length. The following figures refer to the marching of the men of the 1st Battalion Yorkshire Regiment and Dr. Pembrey; the march was for 7 miles with a halt of ten minutes at the end of the first $3\frac{1}{2}$ miles; in no case was any drink taken or urine passed between the times of observation. These conditions apply to all the observations on this group of men with the exception of three days, when the distances were different.

Number of men	Number of observations	Increase in Pulse					Rise in Rectal Temperature.				
		Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day	Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day
							degs. F.	deg. F.	degs. F.	deg. F.	deg. F.
4—1st Battalion Yorks. and M.S.P.	10	20	0	18	15	16	1·7	0·3	1·4	0·4	0·9

Number of men	Loss in Moisture in Grammes					Increase in Weight of Clothes in Grammes				
	Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day	Maximum	Minimum	Average of maxima of each day	Average of minima of each day	Average of mean of each day
4—1st Battalion Yorks. and M.S.P.	1,610	650	1,255	775	..	270	10	185	25	105

IV.—Influence of Marching with different Loads upon the Temperature, Loss of Moisture, and Pulse.

The following table shows, as far as possible, the influence of load. The clothing was the same in the different series and the march was the same in each case; the only disturbing factor is the difference in the external temperature:—

Number of men	Number of observations	Number of days	Load in kilos.	Increase in Pulse			Rise in Rectal Temperature			Loss of Moisture in Grammes			Increase in Weight of Clothing in Grammes			External Temperature	
				Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Dry bulb	Wet bulb
							degs. F.	degs. F.	degs. F.							degs. F.	degs. F.
2—1st Battalion Yorks. and M.S.P.	3	1	0	20	14	16	1·6	0·2	0·9	1,610	1,000	1,300	270	10	166	63·5	58
Ditto, ditto	3	1	6	48	46	47	1·8	1·2	1·0	1,850	1,200	1,600	480	122	354	69	59
Ditto, ditto	3	1	15	40	20	33	1·5	0·7	1·1	1,550	1,160	1,400	520	100	320	59	52
3—1st Battalion Yorks. and M.S.P.	4	1	6	24	8	14	1·6	0·0	0·8	555	300	400	40	0	27	41	35
Ditto, ditto	4	1	7	30	8	21	0·4	−0·5	−0·5	500	350	400	20	0	12	48	37
Ditto, ditto	4	1	13	38	18	27	1·6	0·1	1·0	1,150	750	800	170	30	87	47	43
Private T.	1	1	0	14	..	..	1·0	..	..	1,300	..	..	270	..	..	63·5	58
,, ...	1	1	6	46	..	..	1·8	..	..	2,000	..	..	480	..	..	69	59
,, ...	1	1	15	40	..	..	1·5	..	..	1,490	..	..	520	..	..	59	52

V.—Influence of Marching with Similar Loads but under different Conditions of External Temperature, Moisture, and Wind.

The effect of external conditions is well shown by a comparison of the results obtained in the autumn and early spring.

Number of men	Number of observations	Load in kilos.	Increase in Pulse			Rise in Rectal Temperature			Loss of Moisture in Grammes			Increase in Weight of Clothes in Grammes			External Temperature	
			Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Dry bulb	Wet bulb
						degs. F.	degs. F.	degs. F.							degs. F	degs. F.
3—1st Battalion Yorks. and M.S.P.	4	6	84	52	62	2·3	0·6	1·4	2,390	1,140	1,816	640	60	320	79	67·5
Ditto, ditto	4	6	24	8	14	1·6	0·0	0·8	555	300	419	40	0	27	45	38
Private B.	1	6	48	..	..	1·2	..	..	1,850	..	..	460	..	..	69·5	59·5
,, ...	1	6	8	..	..	0·3	..	..	470	..	..	40	..	..	45	38
Private D.	1	6	24	..	..	1·8	..	..	1,740	..	..	120	..	..	69·5	59·5
,, ...	1	6	12	..	..	1·6	..	..	350	..	..	40	..	..	45	38
Private C.	1	6	38	..	..	0·8	..	..	1,200	..	..	90	..	..	69·5	59·5
,, ...	1	6	12	..	..	0·0	..	..	300	..	..	0	..	..	45	38
M.S.P.	1	6	48	..	..	1·7	..	..	1,420	..	..	122	..	..	69·5	59·5
,, ...	1	6	24	..	..	0·6	..	..	555	..	..	30	..	..	45	38

VI.—Influence of Marching in different Clothing upon the Temperature, Pulse, and Loss of Moisture.

The following data show the influence of clothing, especially upon the evaporation of moisture from the body :—

Number of men	Number of observations	Number of days	Dress	Increase in Pulse			Increase in Rectal Temperature			Loss of Moisture in Grammes			Increase in Weight of Clothes in Grammes			External Temperature	
				Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Dry bulb	Wet bulb
							degs. F.	degs. F.	degs. F.							degs. F.	degs. F.
4—1st Batt. Yorks. and M.S.P.	5	1	No jacket. Drill order	52	16	28	1·6	0·6	1·0	1,430	1,000	1,200	250	0	109	67	58
Ditto, ditto	5	1	Drill order	48	24	41	1·8	0·8	1·5	2,000	1,200	1,600	480	90	254	69	59
Private T.	1	1	Drill order. No jacket	52	..	..	1·3	..	..	1,430	..	..	250	..	..	67	58
,, ...	1	1	Drill order	46	..	..	1·8	..	..	2,000	..	..	480	..	..	69	59
Private B.	1	1	Drill order. No jacket	24	..	..	0·3	..	..	1,300	..	..	220	..	..	67	58
,, ...	1	1	Drill order	48	..	..	1·2	..	..	1,850	..	..	460	..	..	69	59
Private D.	1	1	Drill order. No jacket	16	..	..	1·3	..	..	1,200	..	..	70	..	..	67	58
,, ...	1	1	Drill order	24	..	..	1·8	..	..	1,740	..	..	120	..	..	69	59
Private C.	1	1	Drill order. No jacket	18	..	..	0·6	..	..	1,000	..	..	5	..	..	67	58
,, ...	1	1	Drill order	38	..	..	0·8	..	..	1,200	..	..	90	..	..	69	59
M.S.P.	1	1	Drill order. No jacket	32	..	..	1·6	..	..	1,070	..	..	0	..	..	67	58
,, ...	1	1	Drill order	48	..	..	1·7	..	..	1,420	..	..	122	..	..	69	59

VII.—Influence of Practice upon the Effects produced by Marching.

The influence of practice upon the performance of muscular work is well recognised. A soldier learns to march efficiently only by marching frequently. He learns thereby how to accommodate himself to the demands of muscular work. The physiological explanation of this is well shown by the following comparisons, in which the length of the march was the same in each case.

Number of men	Number of observations	Load in kilos.	Increase in Pulse			Rise in Rectal Temperature			Loss of Moisture in Grammes			Increase in Weight of Clothes in Grammes			External Temperature	
			Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Dry bulb	Wet bulb
						degs.F.	degs.F.	degs.F.							degs.F.	degs. F.
M.S.P., untrained	1	0	70	..	..	2·2	..	..	1,250	..	..	120	..	..	71	65
,, ,, ...	1	0	72	..	..	1·0	..	..	1,000	..	..	20	..	..	72	62
,, trained	1	7	28	..	..	0·6	..	..	960	..	..	(?) 0	..	..	67	63
,, ,, ...	1	14	40	..	..	1·0	..	..	1,160	..	..	100	..	..	61	52
4—1st Battalion Yorks. at beginning of series	4	2	48	40	43	3·0	1·2	2·1	2,100	1,250	1,700	580	200	375	71	65
4—1st Battalion Yorks. at end of series	4	7	26	20	22	1·4	0·5	1·0	1,700	1,050	1,300	370	0	154	67	63·5
4—1st Battalion Yorks. at end of series	4	14	40	16	24	1·5	0·7	1·2	1,550	750	1,200	520	50	245	61	52

It is true that these results are not strictly comparable in all the conditions, but they show that after three weeks practice a man in full marching order can march the same distance over the same road with less fatigue than that shown when he performed the first march in ordinary dress.

VIII.—Influence of Smoking upon the Effects produced by Marching, as shown by the Recovery of the Pulse during a Halt.

1st Battalion Irish Fusiliers	Dress	Pulse at rest	Pulse at halt, 3½ miles	Pulse 8 mins. later	Difference	Pulse on return, 7 miles	Pulse. Minutes later	Difference	Weather: Dry bulb	Weather: Wet bulb
									degs. F.	degs. F.
A. ..	Marching order	78	80	72	8	94	20 mins. later 80	14	58 Slight S.E. wind.	55 Cloudy.
B. ..	,, ...	104	100	96	4	106	20 mins. later 92	14	,,	,,
C. ..	,, ...	68	84	96	+12	104	15 mins. later 76	28	,,	,,
D. ..	,, ...	52	72	64	8	80	25 mins. later 76	4	,,	,,
A. ..	Marching order. Smoked 6 cigarettes	78	84	88	+ 4	108	17 mins. later 94	14	54 Moderate S.W. wind.	51 Cloudy.
B. ..	,, ,, 8 ,,	96	120	100	20	116	25 mins. later 98	18	,,	,,
C. ..	,, ,, 7 ,,	80	104	92	12	116	30 mins. later 88	28	,,	,,
D. ..	,, ,, 6 ,,	60	68	68	0	92	20 mins. later 52	40	,,	,,
A. ..	,, ,, 6 ,,	70	100	84	16	98	25 mins. later 96	2	51 Moderate S.W. wind. last half of March.	48 Raining
B. ..	,, ,, 6 ,,	96	100	80	20	102	20 mins. later 110	+ 8	,,	,,
C. ..	,, ,, 5 ,,	72	100	76	24	86	20 mins. later 100	+ 14	,,	,,
D. ..	,,	60	60	56	4	86	20 mins. later 76	10	,,	,,

IX.—Influence of Drinking upon Effects produced by Marching as shown by the Recovery of the Pulse during a Halt.

1st Battalion Irish Fusiliers	Dress	Pulse at rest	Pulse at halt, 3½ miles	Pulse 8 mins. later	Difference	Pulse on return, 7 miles	Pulse. Minutes later	Difference	Weather: Dry bulb	Weather: Wet bulb
									degs. F.	degs. F.
A. ..	Marching order	78	80	72	8	94	20 mins. later 80	14	58	55
							20 mins. later		Slight S.E. wind.	Cloudy.
B. ..	,, ...	104	100	96	4	106	92	14	,,	,,
							15 mins. later			
C. ..	,, ...	68	84	96	12	104	76	28	,,	,,
							25 mins. later			
D. ..	,, ...	52	72	64	8	80	76	4	,,	,,
							30 mins. later			
A. ..	Marching order. Drank 600 cc. water before starting	66	84	72	12	96	78	18	55	50
							20 mins. later		Slight N.E. wind.	Cloudy.
B. ..	,, ,, ..	88	100	88	12	112	100	12	,,	,,
							20 mins. later			
C. ..	,, ,, ..	76	96	72	24	112	80	32	,,	,,
							20 mins. later			
D. ..	,, ,, ..	56	60	56	4	86	70	16	,,	,,
							29 mins. later			
A. ..	Marching order. Drank 600 cc. beer before starting	84	84	72	12	98	84	14	63	54
							25 mins. later		Slight S.E. wind.	Cloudy.
B. ..	,, ,, ..	88	104	96	8	104	88	16	,,	,,
							30 mins. later			
C. ..	,, ,, ..	90	116	76	40	126	100	26	,,	,,
							30 mins. later			
D. ..	,, ,, ..	72	76	60	16	70	72	2	,,	,,

X.—Influence of the Halts upon the Rapidity of Recovery from the Effects of Marching.

Irish Fusiliers and M.S.P.	Dress	Pulse at rest	Pulse at halt, 3½ miles	Pulse 8 mins. later	Difference	Pulse on return, 7 miles	Pulse. Minutes later	Difference	Dry bulb	Wet bulb
									degs. F.	degs. F.
A. ..	Drill order	74	96	82	14	98	82 30 mins. later	16	48	45
B. ..	,, ...	104	104	90	14	112	100 28 ,,	12	48	45
C. ..	,, ...	70	100	74	26	106	88 25 ,,	18	48	45
D. ..	,, ...	60	76	76	0	86	78 35 ,,	8	48	45
M.S.P..	,, ...	76	112	96 5 mins. later	16	112	82 30 ,,	30	48	45
A. ..	,, ...	70	116	80	36	90	80 20 ,,	10	63	55
B. ..	,, ...	94	108	80	28	116	94 12 ,,	22	63	55
C. ..	,, ...	70	84	72	12	106	100 10 ,,	6	63	55
D. ..	,, ...	64	80	56	24	78	74 15 ,,	4	63	55
M.S.P..	,, ...	84	80	76 6 mins. later	4	120	74 20 ,,	46	63	55
A. ..	Marching order. No great coat	80	84	88	+ 4	96	84 20 ,,	12	70	63
B. ..	,, ,, ,,	92	96	84	12	114	100 15 ,,	14	70	63
C. ..	,, ,, ,,	84	84	84	0	126	80 27 ,,	46	70	63
D. ..	,, ,, ,,	66	84	76	8	100	80 27 ,,	20	70	63
A. ..	Full marching order	78	80	72	8	94	80 20 ,,	14	58	55
B. ..	,, ,, ...	104	100	96	4	106	92 20 ,,	14	58	55
C. ..	,, ,, ...	68	84	96	+12	104	76 15 ,,	28	58	55
D. ..	,, ,, ...	52	72	64	8	80	76 25 ,,	4	58	55

Reviews.

Essentials of Sanitary Science. By Gilbert E. Brooke, M.A.Cantab., L.R.C.P.Edin., D.P.H. London: Henry Kimpton, 1908. Pp. 413. Price 6s. net.

The author begins his preface, or as he prefers to call it, "Foreword," with an apology for adding a new work on Sanitary Science to the long list of volumes on that subject, and it is difficult to avoid agreeing with him on this point at least. He states "that he has endeavoured to make it thoroughly practical, so that it shall be as useful and indispensable in the laboratory as it is in the study." As regards its utility in the first-named place it is only necessary to point out that on two occasions he confuses a normal solution with a standard one. Thus, on p. 114 occurs the remarkable statement that a solution containing 4·78 grammes of nitrate of silver to the litre is a normal solution of that salt, and a similar mis-statement is made on p. 121. In describing the manufacture of nutrient media no allusion at all is made to the necessity of "standardising" all media used for accurate work, a process now, it is to be hoped, universal in all well-conducted laboratories, while all the directions given for the pouring of agar plates are contained in the brief statement that "the process is the same as for gelatine plates." It is to be feared that the student who takes this book as his sole guide in the laboratory is preparing himself for a course of instruction under the hard, but most efficient, instructress, experience. He will, at the least, have an opportunity of learning from his own mistakes, since Dr. Brooke does not trouble to warn him of the innumerable pitfalls of minor bacteriological technique. So much for the laboratory. As regards the study, the position is not much improved. On p. 145, under the heading Diet Scale Calculations, occurs the following table:—

1 ounce albumin	= N. 70 grains, C. 212 grains.
1 ounce fat	= N. 70 grains, C. 336 grains.
1 ounce carbohydrates ..	= N. 70 grains, C. 190 grains.

It is almost impossible to believe that the table means, what in plain English it only can mean, namely, that in 1 ounce of fat there are 70 grains of nitrogen, and the same in 1 ounce of starch or sugar. It is to be feared that the student who calculates his diets by the use of the above scale will arrive at results more interesting than accurate. It is hardly necessary to go further. Dr. Brooke concludes his "Foreword" with a reference to books of "such questionable value to the student, and of such uselessness to the practitioner." It is safe to say that this book can never come under this category, since, however useless it may be to the practitioner there can be no possible question as to its value to the student.

C. H. M.

Hints to Ships' Surgeons. By J. F. Elliott, L.R.C.S., L.R.C.P.Irel. London: John Bale, Sons and Danielsson, Ltd., 1908. Pp. 64. Price 2s. net.

This little book should be useful to medical men who contemplate accepting an appointment in the Mercantile Marine. The usual amount of pay and the cost of outfit might, perhaps, have been given. No mention is made in the two chapters devoted to duties at sea of any special supervision of hygienic conditions—an occupation in which we should have expected the surgeon to take a lively interest.

The author has found the following treatment in obstinate cases of sea-sickness to be better than any medicine: "Rest in a prone position in a swinging cot in a darkened cabin well amidships, away from noise and smells." We would substitute "supine" for prone, and add "with an abundant supply of fresh air." A few grammatical errors are noticeable, *e.g.*, p. 29, "each may know how many of their men are ill."

The book is well printed and readable. It should serve the purpose for which it is intended. W. W. P.

Infected Ears (Intrameatal Treatment). By F. Faulder White, F.R.C.S.Eng. London: Tellon and Mansfield, 1908. Pp. 100. Price 5s. net.

Recognising how proverbially unsatisfactory the treatment of suppurative otitis of the middle ear is, and the large number of people who daily, without mentioning other risks, are running that of poisoning, by chronic absorption from foul ear conditions, any contribution to our present limited knowledge of how to lessen these dangers should be greatly prized. Mr. Faulder White's small work (pp. 100) is an effort to supply this.

The author is, and has been for years, an enthusiastic believer in the intrameatal method of treatment. Holding the view that in the great majority of cases the middle ear is the seat of disease to be attacked, his methods are directed to this end. His treatment may be described as "otectomy," or "cutting out" of any obstacle interfering with the freest drainage from the middle ear through the external auditory meatus. Thus tympanic membrane, ossicles, granulations, or bony walls, may require "cutting out." This is followed up by careful irrigation of the middle ear by non-poisonous warm antiseptic solutions. He authoritatively states that the great majority of chronic suppurative otitis cases can be cured in this way, and furnishes notes of results of many successful cases he has so treated.

He states, moreover, that in his private practice in the last three years, he has neither once had to perform or advise the radical mastoid operation. It must be admitted that his treatment, devoid as it is of serious risks (mortality *nil*), is well worth the fullest trial, it will doubtless commend itself to many patients who, from fear of the more severe and lengthy radical mastoid operation, have given up all hope of ever obtaining relief. To those who have treated old-standing cases of chronic suppurative otitis by the radical mastoid operation, with a result of the renewal of health to the patient, and no further loss of hearing, and who are convinced that the mastoid antrum is the seat of disease to be first dealt with, these views may perhaps prove unconvincing. In the last two years, however, the tide of feeling on this subject has undoubtedly

changed. Otologists in daily increasing numbers now hold that the radical mastoid operation has been used more frequently in the past than was necessary, and that equally good results would have followed measures less severe and of less risk to the patient. Such measures Mr. Faulder White now proposes.

A good many pages are occupied in drawing attention to the regrettable non-recognition and indifference of many public bodies, school authorities, and parents, to the gravity and evil consequence of neglected running ears.

His suggestion of the provision of large institutions, in healthy localities, for the treatment of otorrhœa under skilled supervision, is a most excellent one, which we trust we may one day see carried out.

To all interested in ear affections and their treatment, this little book eminently practical, well written, and moderate in price, will be welcome.

G. A. M.

A Manual of Infectious Diseases. By E. W. Goodall, M.D.Lond., and J. W. Washbourn, C.M.G., M.D.Lond., F.R.C.P. Second Edition, revised and enlarged, by E. W. Goodall. London: H. K. Lewis, 1908. Pp. xii. and 246. Price 14s. net.

This useful book is an eminently practical guide to the practitioner in the diagnosis and treatment of the fevers of Great Britain. The photographs and diagrams are excellent. In the opening chapters, many pages of which are devoted to bacteriology, it is pointed out that one fever increases the susceptibility of the individual to another, Two per cent. of the admissions to the London fever hospitals are cases of concurrent infections. While treating of the modes of conveyance of contagion, the reviser makes no allusion to the classical researches of Flügge and his pupils, by which they proved that the infecting agent may be disseminated in the droplets of mucus and saliva emitted in the acts of speaking, crying, sneezing, &c. Now the reviser quotes the experiments of Stickler who induced scarlet fever in ten healthy children by inoculating them with mucus from the fauces of scarlet fever patients, and the similar positive results obtained by Franz Mayr with the nasal discharge of children suffering from measles. The importance of Flügge's investigations, therefore, is obvious. Sore throat, influenza, tubercle, whooping cough, mumps, diphtheria, cerebrospinal meningitis, in like manner may be disseminated in the spray of the sufferer. The decrease in the virulence of scarlet fever is noted. Stress is laid on the diagnostic value of the circum-oral ring of pallor in marked contrast with the flushed cheeks. The reviser is of opinion that the desquamating cuticle of scarlet fever is no longer infectious after four or five weeks. Isolation should be continued from eight to twelve weeks if any nasal or aural discharge persists. He advocates the use of anti-streptococcic serum in the septic complications of this fever in doses of 10 to 20 cc. only. Crumpton injects 50 cc. intravenously. Most foreign observers employ doses of 100 to 200 cc. Egis and Langovoy claim to have reduced the fatality considerably by the administration of Moser's serum in this quantity. No mention is made of Franklin Roger's favourable experience of chloral hydrate with which he treated 800 cases of scarlet fever, nor do we find any note of the importance of reducing the chloride input in nephritis with dropsy. In mastoid abscess an incision down to the bone is often all

that is required in infancy. In the chapter on diphtheria, the ripe experience of the reviser is displayed. He deprecates the isolation of children whose fauces harbour the pseudo-diphtheria bacillus. Full details of intubation are given, it has been practised 625 times since 1898 at the Eastern Hospital. No reference is made to Marfan's method of extubation, which is performed with the child on his face with his head hanging over the edge of the table; the dangers of the sitting position are avoided. Anaphylaxis is described: This means the occurrence of grave symptoms, collapse, pyrexia, rash, &c., after the administration of antitoxin to those who have received an injection of horse serum more than a fortnight previously. Hence, before giving an antitoxin it is always necessary to ascertain if the patient has thus been rendered hypersensitive by a former dose of serum. The prophylactic use of diphtheria antitoxin should be limited to those cases in which the risk of infection has been great. As an alternative preventive measure, a reference to the use of rectal injections of sterilised cultures of the diphtheria bacillus recommended by Breton and Petit might have been included in the text. In discussing measles the reviser relates how Franz Mayr demonstrated the infectivity of the nasal secretion in 1852 and quotes the epoch-making experiments of L. Hektoen, in which measles was transmitted to two healthy men by inoculating them with twenty-four hour old broth cultures of the blood of measles cases. We look in vain, however, for any mention of the extensive investigations on the blood and discharges of this disease carried out by Giarrè and Carlino, Borini, Czajkowski and Zlatogoroff, and Pacchioni and Francioni, without which no article on measles can be considered complete. The presence of Koplik's spots is stated to be pathognomonic of this disease. It should have been added that a leucocyte count is of value. There is leucopenia in the eruptive stage and a mononuclear increase during convalescence. Scarlet fever, diphtheria, syphilitic roseola thus may be excluded, since leucocytosis occurs in all these infections. According to the reviser the isolation of measles patients should be enforced for three weeks from the appearance of the rash. A week or ten days is deemed sufficient by many. The pathology of whooping cough is hastily dismissed by saying that the microbe has not yet been isolated. Now, D. J. Davis cultivated it in 1906, and proved its pathogenicity on man. Since then it has acquired a considerable literature, to which Bordet and Gengou, Soulima, and Klimenko have made recent contributions. Wollstein has shown that the serum of children suffering from whooping cough agglutinates suspensions of the bacillus. Since the microbe exists in the sputum, it is thrown out with the spray emitted while coughing; the fact that whooping cough is a close range infection, established clinically, thus receives an explanation. Among methods of treatment which might have been given are: the administration of milk of cows or goats which have received injections of antitetanic serum, advocated by Bloch, and the use of fluoroform which, according to Tessier, exerts a specific action. The reviser states that the infecting agent of mumps has not been discovered. Laveran and Catrin isolated the coccus in 1893. Their observations have been confirmed by Tessier and Esmein, and in 1907 by Korentschewsky who obtained the microbe from the saliva, the blood, and from Stenson's duct of affected persons. The serum of such patients agglutinates the coccus.

These important researches in the causation of whooping cough and mumps afford a groundwork for a rational method of prophylaxis by vaccination and of treatment by vaccine therapy. In the account of influenza the occurrence of cases of chronic influenzal pneumonia, often mistaken for tubercle of the lungs, requires notice. The *rôle* of body-lice in causing the spread of relapsing fever has been overlooked. P. Mackie, demonstrated the spirochete in these pediculi. Sargent and Foley have confirmed his observations. The diagnosis of enteric fever by the instillation of typhoid toxin into the conjunctival sac requires attention. Introduced by Calmette, it has been established by Previl (500 cases), and by Malesh and Meroni. The case mortality of enteric fever in those who have been inoculated is half of that in the unprotected. The text requires revision on this point. We find no reference to the vaccine treatment of enteric fever, which was practised by Fraenkel in 1893, and by Richardson in America more recently. The worth of the ophthalmic reaction in the recognition of glanders is too great to allow it to escape notice. The reviser speaks of the serum treatment of plague somewhat disparagingly. Nevertheless, the fatality has been reduced to 14 per cent. in Buenos Ayres, to 23 per cent. in Rio Janeiro, and to 30 per cent. in Queensland by means of it. The death-rate of cases treated otherwise is 75 per cent.

The infectious diseases of Great Britain offer a wide scope for scientific enquiry. We are on the threshold of a new era in their study. Experiments now must supplement clinical and epidemiological observations. We maintain that these fevers soon will be the subject of organised research on the lines pursued by the Americans when they solved the problems of yellow fever and dengue.

Measles attacks half a million of the population of England and Wales every year, and gives a death-roll of 10,000. Analogy teaches us that many of these lives might be saved and much sickness prevented by vaccination with the sterilised or attenuated virus which exists in the blood of measles. We know that by shielding the child from scarlet fever during the earlier years of life he becomes less liable to the infection, and if attacked his chances of recovery are increased. Could not this protection be afforded to him by immunising him with the infecting agent present in the scarlet fever throat? Many crucial experiments are required to determine the conditions of infectivity and immunity on these ailments, and so replace what are now little more than pious opinions by solid facts. Truly here is fit work for a Royal Commission.

C. B.

Current Literature.

Treatment of Insanes in time of War.—In an exhaustive article in the *Deutsche Militäräztliche Zeitschrift* of July 5th, 1908, Dr. Stier tells us that during the last decade experience has shown that the number of cases of mental derangement is much larger in time of war than in peace, and that the longer a war continues the greater is the increase of such cases. The first to suffer are those who show signs of mental weakness, either from hereditary or other causes. With the rank and file it takes the form of hallucinations or epilepsy, with the officers of acute nervous diseases, although, with both, cases of alcoholic mental derangement are much the commonest form.

These results show the necessity of keeping all who are mentally defective out of the Army, for, though it may be possible in time of peace to make fairly useful soldiers of them, in time of war not only are they entirely useless, but they are a source of serious danger and disturbance to the troops. Much has been done in recent years in Germany to prevent mental disease, more particularly with regard to the institution of schools for the training of mentally defective children.

However, in spite of all precautions it will be impossible entirely to eliminate the chances of outbreaks of insanity in the Army, especially in the field, and therefore it is necessary in time of peace to arrange a practical system of treatment of the insane which will ensure the minimum of danger to others and the maximum of benefit to the patient. This is all the more necessary when it is remembered that a single case of insanity gives more trouble and works incalculably more mischief than a number of cases of any other disease.

(1) *Provisional Treatment of the Insane in the Area of Field Operations.*—There is no difficulty in the treatment of the slightly deranged and epileptics, as such men can be sent to the rear with other cases. Unfortunately, however, as the Russians found in the Far East, few cases of slight derangement occur, most of the cases being cases of sudden acute insanity, caused by the sights and sounds of a big battle, and such cases are exceedingly difficult to handle. The first consideration must, of course, be to save those in the fighting line from disturbance, and this can be done by securing and tying up the patients as quickly as possible. Most field hospitals are now provided with a straight waistcoat, and this is likely to hurt the patient less than any other mechanical means of detention; but if possible it is better to avoid the straight waistcoat by administering to the patient hyoscine, or, as it is officially called, *scopolaminum hydrobromicum*. If it is injected subcutaneously it has the effect of entirely and immediately relaxing the patient. A dose containing 0·0006 to 0·001 gramme of hyoscine and 0·002 gramme of morphia may be administered, which will render him at once unconscious. He is then not only harmless, but he can be placed amongst other patients, and does not require a special attendant. If he wakes after several hours, he should be fed as quickly as possible, and another injection administered, which will have a similar effect. This treatment

can be continued for several days. It should be possible to ensure this gentle and effective treatment of cases of insanity by supplying to regimental medical officers and field hospitals small tubes, each containing one such injection. Nevertheless, in case of accidents, straight waistcoats should also be carried, one in each field hospital, twelve in each line of communication hospital, and two in each hospital train.

The drawback to the above treatment with hyoscine is that transport of the patient thus treated to the rear is so dangerous that it is almost impossible. If, therefore, transport is to be made possible, the best thing would be to put the patient into a state of semi-consciousness with sulphonal, or the more expensive but less harmful trional, so that though he is not unconscious it is impossible for him to be refractory, and he will be able to obey orders and even sit up without assistance. To this end the trional should be administered four times daily in doses of 1 gramme, one or two days before transport takes place. Thus, the supply to all medical units of a sufficient quantity of tubes of hyoscine and of trional tablets should suffice for the provisional treatment of all cases of insanity.

(2) *The Care and Treatment of Insanes on the Lines of Communication.*—The experiences of the Russians in the late war shows us that we must also expect increasing numbers of insanes to be constantly sent back from the fighting line to the lines of communication. It will therefore be necessary to arrange for such cases to be kept together as much as possible, and suitable treatment given, until their transport to the home territory can be arranged. Regulations regarding both treatment and transport have recently been published in Germany. The advantage of having all the cases of insanity gathered together in one spot is that suitable alterations in buildings and general arrangements can be made, and the charge of a department for mental diseases can be given over to a mental specialist. The place for the establishment of this section of a line of communication hospital should be the headquarters of the line, as this is also where the inspector-general, his principal medical officer, the sick and wounded transport unit, and the clearing hospital are to be found. Here building operations can easily be carried out, here also will the ambulance trains be available. The number of cases of insanity will naturally depend on circumstances, and will vary from time to time. In the late war the Russians had 3·5 of insanes to every 1,000 admissions to hospital. For an army of three army corps and a reserve division there would be forty field hospitals, with 8,000 beds, and provision should be made, therefore, for about thirty insanes in them. Dr. Stier thinks this a moderate computation, and is of opinion that, should the war be a long one, this accommodation for insanes would have to be much increased. Whether a special section for patients suffering from nervous diseases should also be added depends entirely on circumstances.

With regard to *personnel*, such a section would require, besides the specialist in charge, sick attendants and a N.C.O. of the medical corps, experienced in dealing with insanes, as wardmaster. The latter will be obtainable later on, in consequence of the new establishment of sections for the care and observation of insanes, which have been formed in the military hospitals of Posen, Strassburg, Magdeburg and Dresden. Although not absolutely necessary it would be very desirable in addition

to the above-mentioned *personnel* to have other trained doctors, nursing sisters and attendants available in case extra assistance is wanted. This additional staff might well be supplied by the various provincial asylums in time of war.

If possible, a house surrounded by a garden and standing apart from other buildings should be selected. The internal arrangements should be made so that quiet and violent patients and officers and men are kept as far apart from one another as is feasible. For every thirty patients suffering from mental disease, the Russians found it necessary to provide accommodation for ten officers and for ten quiet and ten violent cases. Alterations are usually limited to strengthening the door and window fastenings, guarding the heating arrangements, lighting the rooms from above or outside, the provision of a water-closet which can be used safely by those affected with suicidal mania, and also a padded room for solitary confinement. Further, Dr. Stier is strongly of opinion that a sufficient number of baths suitable for prolonged bathing should be provided, as this is the best method of quieting violent patients. In order to save unnecessary expenditure in clothing for those whose insanity takes the form of constantly tearing off their clothes, suits made in one piece and fastened up the back, of very strong drill, should be kept in stock. Again, in order to avoid having a very large *personnel* for the care of those delirious or epileptic patients who are constantly falling out of bed and injuring themselves, a special bed should be used. This is not the low wooden bed used in such cases in Germany, but a special pattern of iron bedstead, 1½ metres high and covered with wire netting, made by the Vienna firm of R. Rigl and Co. These beds have the advantage of allowing the patient to be watched and to see things for himself, while they prevent his falling out, and are easily cleaned. Six such beds should be provided for each insane section.

Thus, the material necessary for the mental disease section of a line of communication hospital should be: Six baths arranged to admit of prolonged bathing; twelve untearable suits; six special iron beds; some unbreakable ward utensils made of rubber material; for drugs, hyoscine and trional, as mentioned above, should suffice.

(3) *Transport of Insanes to the Home Territory.* — This may be rendered fairly easy by organising special convoys of insanes, so as to permit of many patients being sent back together and of economising *personnel.* Through carriages and trains with special kitchens are required, as it is better not to disturb such patients. Either an entire auxiliary hospital train should be used or several cars should be attached to an ambulance train, in such a way that it will not be necessary to pass through the cars for insanes in getting from one part to another. The windows of such cars should be fixed and double doors made. All doors should have similar locks, and a sufficient number of keys should be provided for the use of the *personnel.* The same precautions should be taken with the officers' carriages, and officer patients should, if possible, travel in *mufti.* Five men and three officers can travel in one carriage.

(4) *Disposal of Insanes in the Home Territory.*—Agreements have been made with the various provincial asylums to receive a certain number of patients. In time of war each principal medical officer of lines of com-

munication would be provided with a list of such institutions and the number of cases they could receive. Here would be sent all those who had shown symptoms of undoubted insanity, but such as had only given indications of slight derangement should be sent to the new mental diseases sections of military hospitals, where they would be carefully watched and treated. W. G. M.

Plague.—Choksy, in an address on the General Pathology of Serum Treatment of Plague (Bombay: Sanj Vartaman Press, 1908), gives an account of the disease and its treatment which is especially valuable by reason of the author's very large practical experience. With regard to the frequency and mortality of the different forms of plague, we extract the following table:—

Type of plague	Number of cases	Frequency per cent.	Case mortality per cent.
Bubonic	12,080	92·8	74·06
Cellulo-cutaneous ..	497	3·7	63·77
Septicæmic	312	2·4	98·07
Pneumonic	134	1·0	99·25
Pestis ambulans	13	0·1	—

Hindoos showed a distinctly higher mortality (76·5 per cent.) than Mahomedans (68·8 per cent.), or Native Christians (65·8 per cent.). Among Parsees there were 126 cases and 63 deaths.

The author gives a few instances illustrating the extremely infectious nature of the pneumonic form of the disease.

By way of testing the efficacy of serum treatment, alternate cases were given Yersin's serum, rejecting those which were moribund on admission, those who were convalescent or semi-convalescent, and those in whom the disease had lasted more than six days. The result was that 200 cases treated with serum gave a death-rate of 63·5 per cent., whilst a similar number of cases treated without serum gave a mortality of 74 per cent. A previous series of 249 unselected cases treated with serum had given a mortality of 58·6 per cent. In private practice, owing probably to the earlier application of the serum treatment, the results were even better, 245 cases giving a mortality of 40·4 per cent. In a total of 1,103 cases of serum treatment collected from all sources, the mortality rate was 49·5 per cent. The earlier the serum was administered the better the result. Cases treated on the first day of the disease gave a mortality of 30·3 per cent. only (323 cases), while those who did not receive serum till the second day died at the rate of 52·7 per cent. (311 cases), and when serum treatment was postponed till the third day the death-rate was 62·5 per cent. (248 cases). The author brings out a further point, that whereas the injection of serum on the first day cuts short the duration of the disease by one-half and averts complications, treatment on the second day has very much less effect in this direction, and serum administered on the third day has no effect whatever in shortening the disease or averting complications. The quantity of serum given varied

between 100 and 400 cc. in the majority of cases. It was administered hypodermically, but the author is now conducting a series of observations on cases in which a single dose of 200 cc. is given intravenously on admission ; the results of this method will be awaited with much interest.

W. S. H.

Correspondence.

SLEEPING SICKNESS.[1]

TO THE EDITOR OF "THE TIMES."

SIR,—I have received for publication a letter, of which that enclosed is a copy, from Dr. R. U. Moffat, C.M.G., who was Principal Medical Officer of Uganda at the time when the incident described took place.

Dr. Moffat was at Entebbe for the whole period of Dr. Castellani's stay in Uganda, and owing to his official position was in close relation with the members and work of the Sleeping Sickness Commission.

I am, Sirs,

Sleeping Sickness Bureau, Yours faithfully,
The Royal Society, Burlington House, W., ARTHUR G. BAGSHAWE,
October 1st, 1908. *Director.*

DEAR BAGSHAWE,—I have only just seen the correspondence in *The Times* to which you refer in your letter. I am somewhat loth to stir up further unedifying controversy, but as Dr. Castellani mentions me as one of those who was honoured by his confidence, I should like to explain the exact form which the latter took, and you can make what use you think fit of this letter.

There is no doubt whatever that until after Colonel Bruce's arrival in Uganda Dr. Castellani had entirely overlooked the importance of his discovery of trypanosomes in the cerebrospinal fluid of sleeping sickness patients.

If time allowed of it, I could bring forward abundant corroborative evidence of this fact, but let Dr. Castellani's words speak for themselves.

On the morning of Colonel Bruce's arrival I went down to meet the steamer in which he was a passenger. While standing on the pier watching the approaching vessel, Dr. Castellani came up to me and asked me to go aside with him, as he wished to tell me something. He proceeded to say what he was about to relate was strictly confidential and that he wished me to give him a promise that I would not divulge the information. I readily gave the desired promise, my natural inference being that he was going to tell me something personal. He

[1] Printed by permission of the Editor of "*The Times.*"

then informed me that he wished me to know that on several occasions he had found trypanosomes in sleeping sickness patients. I gasped with astonishment, and exclaimed immediately, "Good heavens, Castellani, that may have something to do with the cause of the disease."

His reply and subsequent remarks gave me such a shock that I have never forgotten them, and I can give them in practically his own words.

"No," he said, "I do not think that for a moment. I believe the presence of trypanosomes is merely a case of accidental parasitism, just the same as is that of *Filaria perstans* which we find in so many cases. I do not think it is of any importance as regards sleeping sickness, and I have only told you because I am going away next week, and as I do not intend to tell Colonel Bruce I wish you to know about it, because after I have left he may come across it himself and in that case you will be able to best witness to the fact that I had already made the observation!"

Comment on the above is unnecessary, but as further evidence of how far Dr. Castellani's statements can be relied upon, I may mention that after his departure from Entebbe I learned that some time previously he had divulged his secret to Dr. Baker, though when he told me he assured me that I was the only person whom he had favoured with his confidence.

Bulawayo, Rhodesia,
August 29th, 1908.

Yours truly,
R. U. Moffat.

ENTERIC INCIDENCE AND ITS LESSONS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—The comparative immunity of the troops serving in West Africa from enteric instanced by Major Grattan is fully accounted for in my essay, as they are men of the Royal Garrison Artillery (1st Company), Royal Engineers (1st Company), and N.C.O.'s of the native regiments chiefly; and all enjoy "the privilege of age and experience," and are not exposed to the other factors as are troops serving in India. Want of space prevented the paper being published *in extenso*, or the prominence given to infected food, fluids, flies, fomites, fæcal dust, fingers, and climate enumerated by me in the opening paragraphs, and which explain *in part* the greater incidence of enteric in India than England, would have been apparent.

The strength of British troops in West Africa (228-238), moreover, is too small to afford any reliable data. The "Army Medical Report for 1906," at p. 116, states: "The stations at St. Helena and West Africa come next to be considered. The former was abandoned in October as

a military station, and with an annual strength of only 129, it is obvious but little can be learned.

"The garrison (European) of West Africa is little more important than that of St. Helena, having an average strength for the year of only 232."

In harmony with Colonel Firth's appeal for "a wider view," I ask for impartial investigation of the "protein luxus of consumption theory" as a predisposing cause of enteric; for, firstly, by the method of agreement this causative factor is present in every case and is the only one so invariably present; secondly, by the method of difference this factor is least where the disease is least; and, thirdly, by the method of concomitant variation it is found that this factor and the increase and decrease of enteric vary together. The above are the only scientific tests —the methods of science.

I am, &c.,

GEO. S. THOMSON,
Lieutenant-Colonel, I.M.S.

London,
December 22nd, 1908.

ENTERIC INCIDENCE IN INDIA AND ITS LESSONS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—In studying the discussion on a paper read before the United Services Medical Society on "Enteric Incidence in India, and its Lessons," which appeared in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS for November, I note that Major Grattan, R.A.M.C., stated that "the British troops suffer more from enteric fever in West Africa than in India."

I also have had the opportunity of serving in both West Africa and in India—in the former country at the same time, and as long, as Major Grattan—when I had charge of the "serious case" and "European soldiers" wards at Tower Hill Hospital, and during my tour of service on the Coast I never saw or heard of a case of enteric fever, and my experience (very limited) is that enteric fever is as rare on the West Coast of Africa as blackwater fever is in India. Some cases of continued fever of a low type did occur, but gave a negative Widal, and generally turned out to be cases of ankylostomiasis.

As far as Mount Aureol hospital is concerned, I am unable to make a definite statement, but can safely say that if a case of enteric fever had occurred there we, in Tower Hill, would have been aware of it.

The average strength of European soldiers on the West Coast of Africa for 1905 and 1906 was 235.

1905.	Admissions per 1,000 for enteric fever—		
	West Africa	..	*Nil*
	India ..	..	16·1
1906.			
	West Africa	..	*Nil*
	India ..	..	15·6

West Africa, 1897 to 1905, admissions for enteric fever, 0·8 per 1,000.
India, 1896 to 1906, admissions for enteric fever, 21·6 per 1,000.

Some statistics to prove Major Grattan's statement would be of interest to "old coasters."

I am, &c.,
H. Herrick,
Captain, R.A.M.C.

January 4th, 1908.

DINING-ROOMS IN MILITARY HOSPITALS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—In connexion with the regulations recently published arranging for the establishment of dining-rooms in military hospitals, where practicable, it is not without interest to call attention to a letter written in Crimean days by her late Majesty Queen Victoria, in which, with her usual solicitude for the comfort and welfare of her soldiers, this point is alluded to. The letter is written to Lord Panmure, then Secretary of State for War, is found in "The Letters of Queen Victoria," lately issued, and runs :—

"*Buckingham Palace,*
"*March 5th*, 1855.

"The Queen is very anxious to bring before Lord Panmure the subject which she mentioned to him the other night, viz., that of hospitals for our sick and wounded soldiers. This is absolutely necessary, and *now* is the moment to have them built, for no doubt there would be no difficulty in obtaining the money requisite for this purpose from the strong feeling now existing in the public mind for improvements of all kinds connected with the Army and the well-being and comfort of the soldier.

"Nothing can exceed the attention paid to these poor men in the barracks at Chatham (or rather more Fort Pitt and Brompton), and they are in that respect very comfortable; but the buildings are bad—the wards more like prisons than hospitals; with the windows so high that no one can look out of them; and the generality of the wards are small rooms, with hardly space for you to walk between the beds. *There is no dining-room or hall, so the poor men must have their dinners*

in the same room in which they sleep, and in which some may be dying and, at any rate, many suffering, while others are at their meals."

"Tout vient à qui sait attendre," but the wait has been a long one.

I am, &c.,

M. W. Russell,

Lieutenant-Colonel, R.A.M.C.

London.

MALTA FEVER IN THE SUDAN.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—Captain Bousfield, in his paper on "Malta Fever in the Sudan," in the December Journal, suggests that the prevalence of Malta fever during the hottest months (in the Sudan and in Malta) is due to the poverty of grazing. I think, however, that, at any rate in Malta, the explanation must be looked for elsewhere.

In February and March the kidding season begins, so that during the summer the majority of the goats are in full milk, towards autumn they dry up. The incidence of the fever amongst the Maltese corresponds with the supply of milk. The incidence curve begins to rise in March and steadily goes up month by month till its highest point is reached in June, July, or August, as the case may be. The grazing, such as it is, does not begin to fail before June. The goats in and about the cities and large villages are not dependent on the grazing, as they are well fed on beans, and it is these very goats that are infected with the micrococcus in the largest proportion. The goats kept in the small outlying villages, on the other hand, are dependent on the grazing and are not infected to nearly the same extent as those who are carefully fed and whose milk is a source of income to their owners. Further, it is the animals who are giving the largest quantities of milk that are the most infective. On several occasions on applying the blood agglutination test to a herd, the animal with the highest reaction was found to be the best milker. As the milk gets scanty the micrococcus is apt to lie dormant in the mammary gland until the next parturition, when it gets a fresh lease of reproductive activity.

It would be of interest if Captain Bousfield could state what the custom is in the Sudan as regards the impregnation of the milch goat, and whether it has relation to the greater demand for milk in the hot weather, or, as Major Horrocks has suggested, to the season in which the best grazing is available, so that the pregnant animal can obtain its own fodder. I fancy that the officer mentioned by Captain Bousfield

as having been taken ill at Kassala is the one now in Millbank Hospital, and from whose blood we isolated the *Micrococcus melitensis*. We are, therefore, able to confirm his diagnosis.

I am, &c.,

Millbank, S.W.,
January 10*th*, 1909.

J. Crawford Kennedy,
Captain, R.A.M.C.

ARTIFICIALLY PRODUCED CARDIAC BRUIT.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—In reply to the letter by Captain Davy in a recent number of the Journal suggesting a cause for the bruit described by me in an earlier one, the two men were examined by the other officer and myself with a binaural stethoscope and the explanation he offers is certainly not the correct one, for wherever the murmur was generated it was certainly intrathoracically. Neither of the men made the least attempt to evade any part of his duty, and when we again examined one of them—the other, unfortunately, not being available—some months later the murmur was elicited just as before, and disappeared and reappeared in exactly the same way.

I am, &c.

Norman E. Harding,
Captain, R.A.M.C.

January 17*th*, 1909.

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Original Communications.

THE "EFFECTS OF HEAT" DURING THE SOUTH AFRICAN WAR.

By LIEUTENANT-COLONEL R. J. S. SIMPSON, C.M.G.

Royal Army Medical Corps.

SUNSTROKE, heatstroke, and heat apoplexy are known to be relatively rare in South Africa as compared with other regions of high temperature. During the twenty years 1879-1898, which includes the Zulu and first Boer Wars, out of a total average strength of 92,851, only 28 cases of these three diseases occurred, or 0·3 per 1,000, of which but 3 were fatal. These 28 cases occurred in nine separate years; in the remaining eleven no cases occurred.

For comparison we may take the three years 1903-05 inclusive, where in India, in a total average strength of 211,020, the total admissions for all three types were 1,087, with 142 deaths, or a mean annual admission-rate of 5·15 per 1,000, with a case mortality of about 13 per cent.

In the South African War, between October 13th, 1899, and May 31st, 1902, both inclusive, the total admissions in all ranks for all types of this disease were 1,625, with 15 deaths and 325 invalided out of the country in consequence of the attack, or a mean incidence ratio on the whole strength of 2·68 per 1,000.

The appended table shows the distribution of these cases, 97 of which occurred among the officers, 1,528 among the other ranks.

With regard to the construction of the table, the form has been arranged so as to show the incidence among the total of

the troops from England and from foreign stations as compared with the Colonial troops, and also among the Regular troops (with the Volunteers) as compared with the Imperial Yeomanry. Officers are comparable with the other ranks under each of these headings.

The "incidence per 1,000" is an *annual* ratio, not the mean incidence throughout the war, so that differing periods of exposure have been allowed for, and the rates are comparable with those in the annual reports.

(2) (*a*) *The Relative Incidence in the various Groups in Series of Decreasing Severity.*

	Officers		Other Ranks	
Imperial Yeomanry ..	8·07 per 1,000	± 1·56 ..	5·28 per 1,000	± 0·28
Regulars, Volunteers, and Imperial Yeomanry	5·35 ,,	± 0·40 ..	3·07 ,,	± 0·06
Regulars and Volunteers	5·05 ,,	± 0·41 ..	2·90 ,,	± 0·06
Total strength, all classes	4·99 ,,	± 0·34 ..	2·79 ,,	± 0·05
Colonial Troops	3·79 ,,	± 0·62 ..	1·56 ,,	± 0·08

The sequence is the same in both officers and other ranks.

(*b*) *The Relative Incidence in Regulars and Volunteers compared with the Imperial Yeomanry.*—Officers: The actual difference (3·02) is not significant in relation to the probable difference (1·61). Other ranks: The actual difference (2·38) is about eight times the probable difference (0·29) and is distinctive. The Imperial Yeomanry rank and file had then a considerably higher incidence than the Regulars and Volunteers. Further, the exposure of the Imperial Yeomanry did not begin till the early months of 1900, while, as will be seen later, the greatest degree of prevalence during the campaign occurred during the first six months of the war. Hence the comparison should be made for the same period of exposure; this is done later, and the result is that the difference is somewhat greater than is shown here.

(*c*) *The Relative Incidence in Regulars and Volunteers compared with the Colonial Troops.*—Officers: The actual difference (1·26) is not significant in relation to the probable difference (0·74). Other ranks: The actual difference (1·34) is about thirteen times the probable difference (0·10), and is distinctive. The Colonial troops then had a considerably smaller incidence than the Regulars and Volunteers, and therefore much less than the Imperial Yeomanry. The strength of the Colonial troops is, however, not accurately known, and the incidence-rate can only be approximate,

A. Officers.

EFFECTS OF HEAT, SOUTH AFRICA, 1899-1902.

	Regulars and Volunteers			Imperial Yeomanry			Regulars, Volunteers, and Imperial Yeomanry			Colonials			Total		
Years exposure to risk	13,467			1,487			14,954			4,479			19,433		
	Cases	Incidence per 1,000	D.	Cases	Incidence per 1,000	D.	Cases	Incidence per 1,000	D.	Cases	Incidence per 1,000	D.	Cases	Incidence per 1,000	D.
Sunstroke	42	3·12	2	10	6·72	..	52	3·48	2	13	2·90	..	65	3·34	2
Heatstroke	26	1·93	..	2	1·35	..	28	1·87	..	4	0·89	..	32	1·65	—
Heat apoplexy	..	..	..	..	..	..	..	..	..	..	..	..	..	..	—
Total	68	5·05 ± 0·41	2	12	8·07 ± 1·56	..	80	5·35 ± 0·40	2	17	3·79 ± 0·62	..	97	4·99 ± 0·34	2

B. Warrant and N.C.O.'s and men.

Years exposure to risk	415,018			30,682			445,700			102,518			548,218		
Sunstroke	748	1·80	4	110	3·59	3	858	1·93	7	95	0·93	1	953	1·74	8
Heatstroke	397	0·96	1	51	1·66	..	448	1·00	1	56	0·55	..	504	0·92	1
Heat apoplexy	61	0·14	3	1	0·03	..	62	0·14	3	9	0·08	1	71	0·13	4
Total	1,206	2·90 ± 0·06	8	162	5·28 ± 0·28	3	1,368	3·07 ± 0·06	11	160	1·56 ± 0·08	2	1,528	2·79 ± 0·05	13

C. Differences—A *minus* B.

	Incidence per 1,000	P. D.	Incidence per 1,000	P. D.	Incidence per 1,000	P. D.	Incidence per 1,000	P. D.	Incidence per 1,000	P. D.
Officers	5·05	..	8·07	..	5·35	..	3·79	..	4·99	..
Other Ranks	2·90	..	5·28	..	3·07	..	1·56	..	2·79	..
Difference	2·15	0·41	2·79	1·58	2·28	0·41	2·23	0·63	2·20	0·34

but as the strength was probably not less than that used, the rate is probably not less than the correct rate.

(*d*) *The Period of Exceptional Incidence.*—It will be seen later that the greatest proportion of cases among the Warrant and N.C.O.'s and men of the Regulars (and Volunteers) occurred during the hot season 1899-1900. Out of 1,206 cases of all types in the Regulars and Volunteers, 372 occurred between October 13th, 1899, and March 31st, 1900, leaving 834 cases which occurred during the period April 1, 1900, to May 31st, 1902. These give *annual* incidence-rates per 1,000 as below :—

(*i.*) October, 1899, to March, 1900 7·52 ± 0·26 per 1,000
(*ii.*) April, 1900, to May, 1902 .. 2·28 ± 0·05 ,,

Now up to the end of March, 1900, the numbers of Imperial Yeomanry were small, nor were they exposed to the same extent as the other troops, and for these reasons the whole 162 cases in that corps occurred after March, 1900. We then have for comparison, annual incidences as follows :—

Regulars and Volunteers, April, 1900, to May, 1902 2·28 ± 0·05 per 1,000
Imperial Yeomanry, April, 1900, to May, 1902 .. 5·28 ± 0·28 ,,

or for concurrent periods of exposure, the incidence in the Regulars and Volunteers was about half that in the Imperial Yeomanry.

(*e*) *There are, then, four distinct differences in regard to incidence* :—

(1) It was considerably greater in the officers than in the other ranks, except in the Imperial Yeomanry.

(2) As regards the other ranks alone, it was much greater in the Imperial Yeomanry than in the Regulars and Volunteers.

(3) It was greater in the Regulars and Volunteers than in the Colonial troops.

(4) The incidence in the first five and a half months of the war was much greater than in the corresponding seasons of the following years.

The last difference (4) is of course not of the same type as the first three; it is associated with certain definite conditions which can be comparatively accurately specified, as will be seen later. It depends on variations in exposure in the same body of men, while the others depend on variations between groups submitted to similar exposures.

This rate of October, 1899, to March, 1900 (in the Regulars and Volunteers), is of course only comparable with rates for corresponding periods in the following years :—

		Actual difference	Probable difference
October to March, 1899-1900 ..	7·52 ± 0·26	.. —	.. —
,, 1900-1901 ..	3·92 ± 0·14	.. 3·60	.. 0·29
,, 1901-1902 ..	3·48 ± 0·13	.. 0·44	.. 0·19

That is, in the two later periods, the rates are practically identical, and only a little more than half that which obtained during the first period, when the incidence was almost entirely among the Regular troops, as the Volunteers were too few to influence the results, and the Regulars contained a larger proportion of older "seasoned" men than at any other time. The Imperial Yeomanry are included in the later periods; as their general liability was greater than that of the Regulars, the actual rates shown in these two periods are slightly less favourable in comparison with the Regulars and Volunteers in the first period than was actually the case.

After the end of March, 1900, the various groups were subjected to identical conditions as regards exposure, fatigue, and privation; there was no essential difference in their clothing or equipment. But the Yeomanry and the Colonial troops differed in two respects from the Regulars and Volunteers: (1) they were almost all mounted men, and (2) they were better paid. Now it is quite possible to argue that in the first particular they should have been less liable to suffer from the effects of heat, and in the second that through the indirect results of the possession of money to spend—the possibility of obtaining drink—they were more liable to suffer. But these hypotheses will not meet both cases, increase in the Yeomanry and the decrease in the Colonials, unless we invoke the aid of some other factor. In the case of the Colonials, this may have been and probably was acclimatisation, using that term in a wide extension. In the case of the Yeomanry, some factor, possibly the second noted above, more than counterbalanced any possible advantage due to the first. Here, too, it may be said that the Yeomanry were largely composed of men fresh from England, but on the other hand, the Regulars and Volunteers had, as time went on, an increasing proportion of young and immature men, while their highest incidence rate was at a time when the proportion of young men was the smallest throughout the whole campaign. It does not seem possible to strike a balance between these various factors, and so give any explanation of the difference in incidence which will agree with all the facts. One other factor remains to be mentioned, the matter of diagnosis. No doubt there was considerable confusion in this respect, as is pointed out below; but this element does not seem to be effective if the totals of all types are

considered, the distribution in the various groups in the table is comparatively regular.

The difference between officers and men in each group is also difficult to account for. There is little to be said on this point which has not been said above. Probably officers were on the whole rather more exposed than the men; whether this is sufficient to account for the difference in incidence is doubtful.

(3) *Deaths.*—The fifteen fatal cases were distributed as follows: Sunstroke, 10 in 1,018 cases, including two officers; one case died in hospital. Heatstroke, 1 in 504 cases. Heat apoplexy, 4 in 71 cases; one case died out of hospital.

The case mortality is less than 0·1 per cent. of all cases. The numbers are too small to allow of any statistical treatment.

The geographical distribution was quite irregular. Two deaths occurred at sea, which are noteworthy from the rarity of this affection on the high seas.

The seasonal distribution is curious. Four occurred in the quarter January to March (hot weather), four in the period June to August (cold weather), two in April and one in September, which may be termed intermediate months. Four cannot be distributed. Season appears, then, to have been without influence on the death-rate.

Particulars of the period under treatment are available in thirteen cases: Two died out of hospital, *i.e.*, suddenly; three after two days in hospital; one after four days in hospital; one after five days in hospital; two after seven days in hospital; four between twelve and fourteen days in hospital. That is, the majority died, not from a sudden disturbance or destruction of the nervous centres, or from cardiac failure, but from pathological changes of slower development. Seven of the deaths occurred in 1900, the remaining four of which full particulars are available, in 1901. There is little to be gained by further discussion of so small a number of cases.

(4) *The Validity of the Distinction between the different Types of Disease.*—It may be said at the outset, that there appears to be no possibility of differentiating between heatstroke and heat apoplexy, and one is relieved to find that in the last edition of the nomenclature of the Colleges of Physicians and Surgeons, a source of confusion has been removed by the exclusion of the latter term.

If one examines the manner in which these various terms are used in the text-books, the only possible conclusion is that the actual pathological conditions to which anyone of these may be applied

must remain largely a matter of conjecture. But in practice, at least in the Service, it appears to be the custom to apply the term sunstroke to the pathological state arising within a comparatively short time after actual exposure to the sun, and the term heatstroke when this antecedent is absent. This is no doubt the reason why the proportion of sunstroke during the war remained in all the groups considerably, and occasionally greatly above the proportion of heatstroke, as the history of exposure was almost always available. But there is so much confusion in the nomenclature of these pathological states, that a comparison of the relative

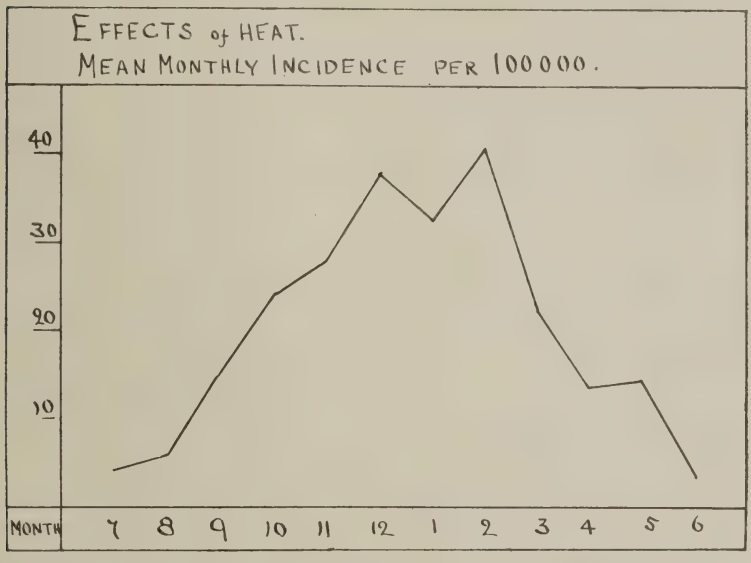

FIG. 1.

proportions of each type of disease in each of the various groups does not appear to be profitable. Hence the admissions will be dealt with as a whole, and little attention paid to distinctions between types.

(5) *The Seasonal Distribution throughout the Year; Aggregate of the whole Period.*—This is most easily seen in the diagram, fig. 1, where the incidence is shown (for convenience of plotting) per 100,000 on the mid-monthly strengths. Two points are evident: The greater incidence in the hot weather months, October to March, with a smaller incidence persisting throughout the rest of the year.

Secondly, the month of maximum severity was February, in which the incidence was 43 per 100,000. Investigation shows that the decrease in January is probably accidental, not an expression of fact, as the actual differences in the rates in December and January

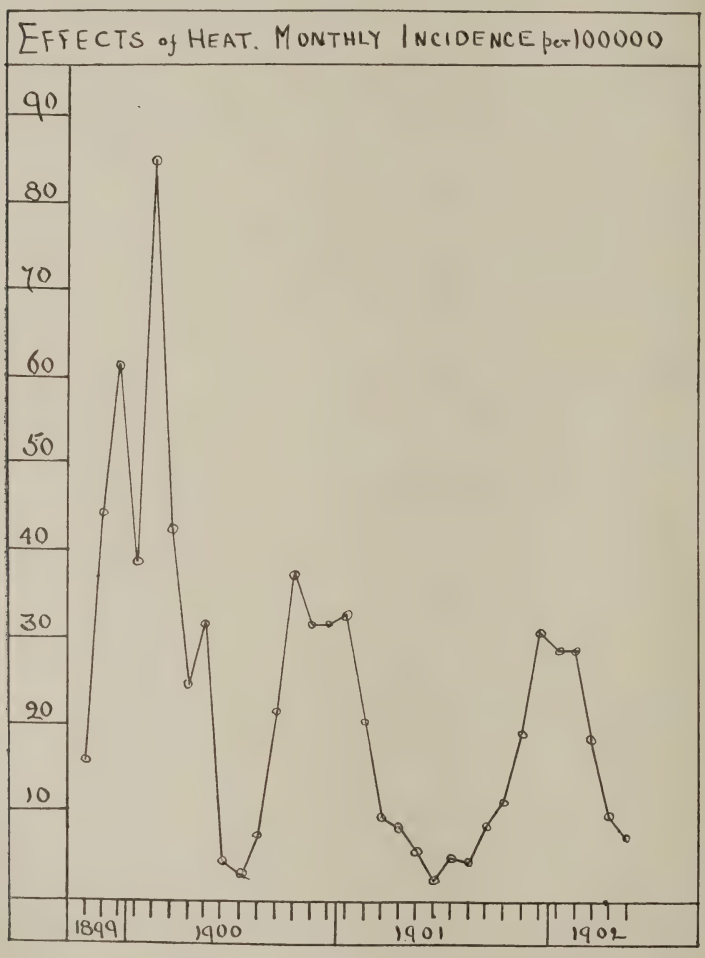

FIG. 2.

are not significant as compared with the probable differences. Hence the curve should show a steady ascent to the maximum in February, followed by a comparatively rapid fall.

(6) *The Monthly Incidence throughout the War.* (See fig. 2.)

Three elements affect this incidence :—

(*a*) The strength of troops : (i.) Total strength in the country; (ii.) local strengths, *i.e.*, distribution.

(*b*) The severity of the military operations.

(*c*) Climatic conditions : (i.) Seasonal variations; (ii.) local variations.

(*a*) *The Strength of the Troops.*—(i.) In the country. Material variations occurred during the first months of the war, necessitating the employment of mid-monthly strength in calculation. But for this, it would have been sufficiently accurate to make use of the actual numbers of cases. (ii.) Local distribution was important. The concentration on the western line in the hot season of 1899-1900 resulted in a high prevalence there as compared with other seasons. As it is impossible to obtain local strength, the geographical distribution (*vide infra*) is materially obscured by this factor, as actual cases alone can be considered. But the geographical distribution of the troops cannot be neglected entirely; this concentration near Kimberley is a case in point. Local distribution was also related to the next factor.

(*b*) *The Degree of Severity of the Military Operations.*—This has, of course, always been recognised as an important factor in relation to the prevalence of the diseases dealt with here. In the South African War, variations occurred both in time and space.

The results of these operations were :—

(i.) *Direct effect :* Unusual muscular exertion and resultant fatigue. (ii.) *Indirect effect :* (*a*) Interrupted and lost sleep; (*b*) irregularity and occasional deficiency in the supply of food and water.

Of these, probably the most important is the direct increase in muscular exertion, under unfavourable conditions. The recent observations of Drs. Haldane and Pembrey, and the observations of others at earlier dates, have shown the very important effect of muscular work on the internal temperature of the body, especially where the air temperature is high and the clothing is not of the very lightest description. "It has also been clearly proved by Dr. Sutton, of Oxford University, that the respiratory exchange, and consequently the heat production in the body, rises very markedly with even a slight increase in the rectal temperature. Hence the heat loss cannot catch up the heat production, and the body is in a vicious circle" (Haldane, *Science Progress*, January, 1908, p. 393).[1] Dr. Haldane's experiments show how the body

[1] See also Dr. Sutton's article in the *Journal of Pathology*, July, 1908.

temperature continues to rise while the temperature of the air continues constant, provided the wet-bulb temperature is over a certain "critical point." This tendency of the body temperature to continue to increase while the exposure continues, must be a most important element in the production of those effects which are variously called sunstroke or heatstroke.

This rise of temperature may be due to a high air temperature alone (especially a high wet-bulb temperature), with little or no external work, or to the effects of external work while exposed to an air temperature which is high, but not so high as in the first case. Dr. Haldane's observations have shown that the two terms, work and external temperature, are to some extent interchangeable, that is, that the critical temperature falls when the subject is at work, and rises when he is at rest, especially in moving air, or the combined influence of these two factors forms a constant, possibly so far ill defined. Hence, one may use such a phrase as the "intensity of exposure" to express the resultant of the two factors—work and external temperature.

The soldier on service is of course required not only to undertake severe muscular exertion in marching, but in carrying a considerable weight, while at the same time he is hampered to some degree by his equipment. No arrangement can ever be devised which will leave all his movements as free as those of a man who does not need to carry rifle, ammunition, and food, the irreducible minimum.

It is a familiar observation that the effects of heat are commonest when troops are moving in close order, as in column on the march, where the centre of the column gets less air than the sides or ends. During the actual fighting, the same close formation did not exist; the rapid advance in open order was followed by periods, often prolonged, in which the men were more or less prone on the ground, or at least in such a position that they were situated in the lowest stratum of air, of smallest velocity and highest temperature, where they received the full radiation from the ground, at times when a stone or rock was too hot to touch with comfort. Under these conditions, unprotected parts of the body—arms, or legs—became highly inflamed from the direct action of the sun, an action which personal experience even on Table Mountain has shown to be severe.

It is evident that the more the men are exposed to such conditions the more likely are they to show a febrile reaction which may assume the form usually described under one of the

types dealt with here, possibly with cardiac or cerebral symptoms, or may manifest itself as a comparatively mild febricula of short duration. A proportion of the cases of simple continued fever which occurred on the march to Bloemfontein appear to have been of this nature; such at least was the opinion of those who saw them at the time, and their rapid and complete recovery when placed under more favourable conditions corroborates this.

(ii.) The "indirect effects" are more directed towards the depreciation of the general "fitness" of the soldier, that is, his power of accommodating himself to rapid changes either in his surroundings (in this special case, external temperature), or in his internal work, especially that of the heart. As a matter of common experience, prolonged irregularities, either in food or sleep, undoubtedly diminish this accommodation, in some cases permanently during the duration of the conditions, in others of higher adaptability, till a still higher degree of accommodation has been attained. During the later stages of the campaign, a large number of the men had attained this degree of accommodation, as in many laborious trades and occupations where men appear to be perfectly healthy under circumstances which would break down the new hand without this practical training. It is possible that this may be, in fact, not due to any higher adaptability of the body, but to the art which has been acquired of doing work in the most economical way, with the least expenditure of energy, and this certainly appears to be a most important factor in the greater resistance of the war-trained soldier.

(*c*) *Climatic Conditions.* (i) *Seasonal variations:* Of these the most important are:—

(1) The conjunction of the hot and the rainy season throughout the greater part of the area of military operations.

(2) The extreme dryness throughout the remainder of the year. At all times of the year there is normally a brilliant sun, and usually some considerable movement of the air.

(ii.) *Local variations:* The greater part of the area of operations had the same general character, that of an open upland plateau, from 3,000 to 5,000 feet above the sea. The only important exceptions were the Krokodil Valley (from which only three cases were reported, all sunstroke), the Barberton Valley (two cases, sunstroke), and a few shallow valleys such as that in which Pretoria is situated, Rustenburg, and certain other small places; the coast-belt of Cape Colony (which is in the area of the winter rains, and so differs from the rest of the area), and the low ground in Natal.

It is, of course, impossible to get any meteorological statistics relating to any great part of the area of operations during the war. The meteorological records in South Africa have been somewhat imperfect; the report of the Cape Meteorological Commission gives particulars regarding a number of stations, few of which, however, are of much value in this connection; similarly, the report of the Government Astronomer in Durban gives some records for Natal. Other partial records are also available, but none which in any way cover the area from which the cases were drawn. We have, then, neither a correspondence in time nor in place between such meteorological records as are available and the record of cases. The meteorological factor can then be stated only in general terms.

Cape Colony is Supan's "Cape" climatic province, sub-tropical. The rest of South Africa is included in his "African Tropical" province. In January, the hottest month, the isotherms form a remarkably regular system of concentric ellipses, whose major axes, situated a little to the east of 24° E. longitude, incline slightly from east to west. Practically the whole of the area of operations in the Transvaal and Orange Free State, Northern Cape Colony, and Northern Natal is included between the January isotherms of 92·5° and 82·5°. The isotherm of 92·5° passes through Kimberley in a north-easterly direction to the Western Transvaal, and it is in this area that the highest recorded air temperatures are met with.

The table on p. 255 shows some observations at certain stations in individual years, gathered from various sources, which give an idea of the existing conditions.

The mean maximum temperatures and the absolute maxima are seen to be really high at times: the actual date of their occurrence is determined largely by the direction of the wind, as in many places the hot, dry winds set in comparatively early in some years. The two points of greater importance in this connection are the absolute wet-bulb temperature and the relative humidity. The wet-bulb reading of 77·7° in Kimberley in 1897 is the highest which has been traced in the material at disposal. Then follow Philippolis (74·3°), Bloemfontein (67·8°), and Hopetown (64·8°) at the angles of an irregular quadrilateral, in which much of the severest work of the campaign was done. The importance of this area will be seen later when the distribution is considered. Kingwilliamstown, with a wet-bulb reading of 71·4°, is in a totally different geographical position, only about 27 miles from the sea. Capetown and East London are also not comparable with the upland stations.

The relative humidity is usually low; in none of the upland stations are the values unusually high, even at the worst. Unfortunately no records are available from the low valleys away from the coast, which have been mentioned above. One would expect to find considerably higher figures from these areas.

Station	Mean maximum	Month	Absolute maximum	Month	Wet-bulb	Month	Humidity	Month
Kimberley ..	96·3	Dec.	102·8	Feb.	77·8	Dec.	75 per cent.	Dec., 1897.
Hopetown ..	94·5	Dec.	103·0	Nov.	64·8	Dec.	71 ,,	June, 1897.
Johannesburg	85·1	Nov.	95·0	Dec.	61·8	Dec.	68 ,,	Jan., 1897.
,,	79·3	Nov.	92·0	Nov.	58·0	Feb.	80 ,,	Feb., 1904-05.
,,	81·9	Jan.	91·0	Dec.	60·7	Jan.	..	Feb., 1905-06.
Aliwal North	86·4	Dec.	96·0	Dec.	63·0	Dec.	79 ,,	Jan., 1897.
Bloemfontein	91·4	Dec.	97·4	Dec.	67·8	Dec.	78 ,,	June, 1897.
Capetown ..	83·4	Jan. and Feb.	104·0	Mar.	66·0	Jan.	85 ,,	July, 1897.
East London	74·3	Jan.	94·0	Aug.	66·4	Jan.	83 ,,	Feb., 1897.
Kingwilliamstown	84·9	Dec.	108·0	Dec.	71·4	Dec.	82 ,,	April, 1897.
Philippolis ..	86·7	Feb.	96·2	Nov.	74·3	Dec.	68 ,,	Jan. and Mar., 1897.
							Relative humidity	
Maritzburg ..	89·4	Dec.	111·8	Nov.			67 per cent.,	Jan., 1897.
							68 ,,	June, 1897.
,,	94·0	Jan.	111·0	Jan.			61 ,,	Feb. and Mar., 1906.
Pretoria (Robert's Heights)	84·1	Jan.	91·0	Jan.			67 ,,	Mar., 1906.

Another element which has to be considered in this connection is the actinic power of the solar radiation, to which some observers have attributed those effects of direct exposure which are known as sunstroke. There is a good deal of difficulty in dealing with this point. The first question to be answered concerns the reality of the effects produced by the wearing of garments, or linings to head-coverings or garments, which absorb some part of the radiations of shorter wave-length, reality being taken to mean an actual difference in the physical conditions. There appears to be no doubt respecting the difference in comfort produced by the use of coloured glasses, or better still of smoked glasses, and there is some evidence that red clothing or red linings have an appreciable effect. But it does not seem possible to account for this on a purely physical basis. It is, however, unnecessary to discuss this point here. The second question relates to the actinic value of the light in South

Africa, and it is convenient to compare it with the light in this country as a standard. There appear, however, to be no direct observations on this point in South Africa, none at least which are complete and available for discussion. One knows generally that the average value is greater than in England, on account of the lower latitude and the greater clearness of the atmosphere, but the sum of these differences is not great. Comparing an average bright summer day in England with the average South African day, it is probable that the difference between the two is not greater than 3 : 1, and is very possibly less. A good deal of photographic experience in both countries appears to show that, with other conditions as nearly alike as possible, results will be satisfactory on the assumption that the light in South Africa has twice the actinic power of that in England.

It is difficult to say whether or not this difference is practically important in the production of sunstroke. There have been, of course, in England occasions (on manœuvres or route marches) where a heavy incidence of all types of these disorders has occurred. During the last three years, the incidence in England of all three types has ranged between 0·13 and 0·42 per 1,000; this incidence is calculated on the total strength in the country, not on those exposed under the special conditions referred to. Now the mean incidence in South Africa in the twenty years ending in 1898 was 0·3 per 1,000, and only in the two years, 1886 and 1896, did the incidence exceed (and then slightly) 1 per 1,000.

It is impossible with our present knowledge to separate the actinic from the heating effects of the solar radiation. Generally speaking, the two increase together, but the actinic power decreases before the air temperature, whose maximum is after the greatest altitude of the sun. So, in comparing the South African incidence-rates with those at home, one has to remember that, quite apart from variations in the actinic power, the temperature conditions (whose influence is indisputable) continue to be favourable to the production of these disorders for about twice the time (at least four months) that they are favourable in this country.

It seems difficult to avoid the conclusion that if variations in the actinic power of the light are in any way effective, the results of their action are so insignificant as to be obscured by those of other and more effective agents.

(7) It is not possible to separate the effects of these three factors —strength, severity of the military operations, and climatic conditions—with any degree of accuracy or detail, but certain of the broader features are perfectly distinct.

Fig. 2 shows the monthly incidence per 100,000 for each month of the war. The seasonal distribution is well marked, but most striking is the difference between the incidence during the first year and that in the other two years. We find not only a much higher rate of incidence, but the continuance of a high rate throughout a prolonged period. This has been already referred to in para. 2 (*e*) (4). From November, 1899, to May, 1900, the rate remained continuously above any other rate except those during the actual hot weather months of the two following seasons ; in fact, even in April and May, 1900, the actual admission-rate was not much below the hot weather rate of 1902.

The distinguishing feature of this period of the war, as compared with later periods, was the severity of the military operations in which the troops were engaged. It covers, on the one side, the advance in Natal and the relief of Ladysmith, and the advance of General Buller's force into the Transvaal. On the other side, it includes the operations under Lord Methuen, the relief of Kimberley, the advance to Bloemfontein and to Pretoria. At no other period of the war were so many men exposed to such a degree of fatigue and privation.

It is probable that a certain degree of adaptation to the climate and conditions obtained during the last two years which was wanting in this period ; those men who had escaped disease were harder and fitter than in their first year, and beyond this physical improvement there was an adaptation of the means to the end which was absent earlier. Men had learnt by experience how to obtain the maximum of comfort with the smallest materials, and the general conditions of life had in many ways improved. On the other hand, the proportion of young soldiers had increased, and the physique of the reinforcements did not improve as time went on. These reinforcements in gross had the benefit of the experience of the others, but still one may set off immaturity of a larger proportion of the force against the other conditions, and so eliminate both elements, leaving the difference in war conditions as the effective element. This appears to be evident in the following section.

(8) *The Geographical Distribution.*—Materials are available from which it is possible to show the geographical distribution of the cases of each type for the whole duration of the war. Such a statement, however, would be misleading, as it is not possible, for obvious reasons, to bring the numbers of cases into any relation with the strengths or even the periods of occupation of the various

stations. A complete statement of these conditions would mean practically a detailed history of the war. It has been shown previously (para. 2, *d*) that the incidence during the hot season 1899-1900 far exceeded that in the next two seasons; 372 out of 1,206 cases occurred between October 13th, 1899, and March 31st, 1900, giving an incidence-rate of 7·52 per 1,000, as against 2·28 for the remainder of the war.

On further examination one finds that of these 372 cases, no less than 306, or 82 per cent., occurred in two groups of men—the army in Natal and that on the western line between De Aar and Kimberley. Of this 306, 216 occurred on the western line, and 90 in Natal. One must again, unfortunately, deal only with numbers, not ratios, but even here a distinction is to be observed between the two areas. On the western line, of the 216 cases, 101 occurred at Modder River, and 51 at Orange River; these were, of course, the points at which the greatest concentration of troops took place, but it is to be noted that at Modder River 57, or more than half the cases, occurred in February at the beginning of the operations for the relief of Kimberley. The distribution on the western line for this month of February shows the places through which troops were passing, and round which operations involving severe exposure and fatigue were taking place.

In Natal, the concentration of cases in close touch with active operations is not so striking. Ladysmith contributes only eight cases in spite of the stress and privation to which the garrison was subjected, a garrison, however, which was almost entirely composed of "seasoned" men. The standing camps at Frere, Chieveley, and Maritzburg show the greatest number of admissions, and with regard to the two former stations it is probable that the admissions were in fact cases contracted in the field, which did not pass through the hospitals with the field army. In Maritzburg, however, this was not the case, and the incidence there, especially in March, 1900, was probably due to the facility with which drink was procurable.

It is unfortunately impossible to differentiate the two elements determining the number of cases, the number of men exposed, and the intensity of the exposure. In this particular period, October, 1899, to March, 1900, the bulk of the troops were undoubtedly in the areas from which the 82 per cent of the total cases during this period were drawn. Outside these areas, the troops were concentrated in much smaller numbers to the south of the Orange Free State and around Stormberg. One then finds that of the sixty-six

cases not derived from the two special areas referred to above, an important proportion came from the south of the Free State. The predominant influence of the intensity of exposure cannot then be shown from these instances, in which mere numbers exposed might suffice to account for the distribution of cases, but nevertheless we must remember the meteorological conditions affecting the west and south of the Free State, referred to above.

We have, however, in the comparison of the first with the two succeeding hot seasons a means of comparing these intensities. In neither of the later seasons were the demands on the troops nearly as severe or continuous as those during the operations in Natal and on the western line. There was no important difference in the meteorological conditions of these three seasons. Yet we see from diagram 2 how far the incidence per 1,000 in the first season exceeded that in the two succeeding seasons, and further, the prolongation of the incidence into the cold-weather months of 1900, when at Bloemfontein in May, at the time of Lord Roberts' advance to Pretoria, a larger proportion of cases was admitted than in any other season.

The admissions at certain stations have been plotted out month by month, but the discussion of these figures appears of very little use without an intimate knowledge of all that was going on in and around these stations. As in other diseases, the investigation of the etiology of the effects of heat requires observations *ad hoc* carried on during the period of exposure; the autopsy of the usual documentary evidence can only give imperfect results, which, too, are misleading if the examination be pushed too far into detail. No one with any practical knowledge of the conditions as they occurred in South Africa can expect that organised investigation over an area of sufficient extent can be carried on with a staff whose time is overwhelmingly occupied with the prevention and cure of disease. Under such conditions, one must work either on established lines or on evidence which is patent; one cannot expect to get results of any value from partial and incomplete enquiry. Until such time when a staff can be devoted to the scientific investigation of disease in the field, that historian is wisest who confines his conclusions to the broader results.

One of these results appears of some importance in relation to one theory of the etiology of these diseases, and that is the practical absence of all types from the hot, deep, and humid valleys of the Krokodil River and Barberton. From the former only three cases and from the latter only two cases were reported. This did not

depend on the absence of troops; both valleys were fully occupied during the last two hot seasons, and the troops on their entry there had a very arduous task.

The following is the general distribution of the cases among the Regulars, Volunteers, and Imperial Yeomanry (not including officers): Sunstroke—Total cases, 858; deduct, 31 ("at sea," 8; station or date not known, 23), 827. These 827 cases occurred in 109 stations, an average of 7·6 per station. 565 cases occurred in 20 stations, none of which showed less than 10 cases, an average of 28 cases per station, or 18·3 per cent. of the stations returned 68·3 per cent. of the cases; four-fifths of the stations had only a few cases. Heatstroke—Total cases, 448; deduct 2 "at sea," 446. These 446 cases occurred in 75 stations, an average of 6 per station. 287 occurred in 10 stations, none of which returned less than 10 cases, an average of 29 cases per station, or 13·3 per cent. of the stations returned 64·4 per cent. of the cases. Heat apoplexy—Total cases, 62; deduct 4 "at sea," 58. These 58 cases occurred in 28 stations, no station showed as many as 10 cases. Fifteen stations returned only 1 case each, or 13 stations returned 43 cases; that is, 46·5 per cent. of the stations returned 74·2 per cent. of the cases.

These figures seem to show that the syndrome termed "heat apoplexy," though less prevalent, was more widely distributed than either of the other forms. But, as has already been pointed out, it is very difficult to accept the validity of the distinction between the various types, and any attempt to draw conclusions from this is therefore futile.

(9) *Accessory Influences: Dress, Food, Drink.*—Dress is always important in relation to the effects of heat. General experience shows that the essentials are that it shall be light in weight but not too thin, loose, especially about the neck and over the chest, and of a colour and material by which the balance between absorption and radiation is satisfactorily maintained. Sufficient strength to resist rough usage at times interferes with one or other of these requirements, as for example, in the case of some of the breeches issued for the Mounted Infantry, which were heavy and very warm. On the whole, however, the service dress in South Africa could hardly have been improved on; it was eminently suited to the climate. At the beginning of the war there was a tendency to too close fitting, and the helmet was generally worn, but these two faults were eliminated very early; the felt hat in particular was far better suited to the climate than the helmet.

Food.—The quantity was usually sufficient, though periods of general deficiency and of partial deficiency did occur. The most important fault was the excessive proportion of meat that was issued at certain times, particularly during the last year of the war.

Drink.—Outside the larger towns, the question of drink was not of much importance, both on account of its scarcity and its cost. It may have been, in fact probably was, an element in increasing the number of cases in such places as Pretoria, Bloemfontein, Capetown, and Maritzburg. Payments to the troops were irregular, and many men, especially those of the Imperial Yeomanry and Colonial Corps, were in possession of large sums of money.

Recapitulation of the Facts.—The chief points may be summarised as follows: (*a*) The incidence per 1,000 of strength during the war was (i.) very much greater than during the previous twenty years in South Africa—2·68 against 0·30 per 1,000; (ii.) about half that in India during the three years 1903-05—2·68 against 5·15 per 1,000.

(*b*) The mortality per 100 cases admitted during the war was less than 0·1 per cent., as compared with about 13 per cent. in India during the three years mentioned. The mortality in South Africa during the twenty years before the war (three deaths in twenty-eight cases) is too short a series for comparison.

(*c*) The relative incidence in the various groups: (i.) The incidence among the officers in the Regulars, Volunteers, and Colonials was distinctly greater than among the "other ranks" of each group, but there is no essential difference between the incidences in the different groups of officers; all suffered to practically the same extent.

(ii.) The incidence among the "other ranks."

The Regulars and Volunteers showed an incidence which was for concurrent periods of exposure (between April 1st, 1900, and May 31st, 1902), about half that in the Imperial Yeomanry—2·28 as against 5·28 per 1,000.

The Regulars and Volunteers showed an incidence which was distinctly greater than that among the Colonial troops, 2·90 as against 1·56 per 1,000.

(*d*) The period of the greatest incidence was during the time of greatest military activity, the first five and a half months of the war. In the group Regulars and Volunteers the incidence during this period was 7·52, as against 2·28 per 1,000 for the remainder of the war.

(*e*) The place of greatest incidence was the area of most intense exposure, that is the western line, with Natal, in which areas

306 cases occurred of the 372 which were reported between the beginning of the war and the end of March, 1900.

(*f*) The seasonal distribution during the last two years corresponded with the temperature curve; during the first year there was an unusual prolongation into the cold weather months.

(*g*) Meteorological observations are imperfect and incomplete, but those which exist show that the area in which the operations for the relief of Kimberley and the advance to Bloemfontein took place is probably a region where the mean maximum and wet-bulb temperatures are at least as high as in any other part of the area of operations.

(*h*) The deep humid valleys of high mean temperature did not show a large proportion of cases. On the contrary, the numbers are probably smaller in proportion to the strength than from other localities. Here the possibility of some confusion with malarial fever must not be overlooked.

(*j*) Accessory causes—dress, food, and drink—had little influence on the general prevalence of these diseases.

Conclusions.—The materials are, as has been shown, imperfect, and for this reason only the broader facts can be dealt with. The following conclusions appear justifiable:—

(i.) In the majority of cases, the etiological factor was the combined influence of exertion and a high external temperature. This appears evident from the distribution of cases in time and space. There appears to be no need to introduce the hypothesis of an unrecognised organism to account for the facts.

(ii.) Positive evidence of the influence of the actinic power of the sun is wanting; analogy leads one to believe that this influence can at most be only secondary.

(iii.) There appears to be a probability of some degree of accommodation, of the acquisition of an increased power of resistance to the disturbing effects of exposure, seen in the small incidence on the "seasoned" garrison of Ladysmith, the differences between the three groups—Colonials, Regulars and Volunteer, and Imperial Yeomanry. Part of this is certainly not vital, but the result of economy of labour due to experience; part, however, may be due to a readjustment of the regulating mechanisms of the body, as in the case of stokers, puddlers, and others employed in similar occupations.

(iv.) The mortality among the cases was so small (under 0·1 per cent.) as compared with India, that it suggests a great difference in the type of disease. If the differentiation of types is to be relied on, heat apoplexy in South Africa was as usual the most fatal, but

even here the death-rate—four deaths in seventy-one cases—was low. One has to remember in relation to this possible difference in type that in South Africa the period between sunset and sunrise is at its worst comparatively cool, and that for this reason the exposure to a temperature which is detrimental is always shorter than it is in India.

This appears to be the only particular in which these diseases in South Africa differed from similar diseases elsewhere, the comparatively small morbidity and very low mortality. In respect of other particulars, there was little departure from the results of previous experience, but the prolongation of the campaign through three hot seasons enabled one to see more distinctly than is usually the case, the close association between excessive exposure and incidence, and the effect of accommodation. The case was simplified, too, by the absence of malarial fevers from the greater part of the area of operations. In no previous campaign in a hot climate has such an opportunity been afforded.

THE SWEDISH SYSTEM OF TRAINING AS APPLIED TO THE RECRUIT, ITS PURPOSE AND METHOD OF ACCOMPLISHMENT.

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The duties associated with the appointment of Medical Inspector of Recruits having brought me into close touch with the physical training schools in the Irish Command, I have been afforded exceptional opportunity of observing the practical application of the existing system of training since its inception. I propose in this paper to record my experience in connection therewith, and to add some suggestions which it is hoped will assist towards its efficiency.

It will be well, however, first to briefly consider the recruit from the point of view of (1) his *physique*; (2) the *work* he is employed to undertake in a soldier's capacity; (3) *the principles of the training method applied* to correct his defects and fit him for his special work. As a result of these investigations it is hoped that a clear understanding will be come to regarding the objects in view and their method of accomplishment.

The average age of approved recruits is 19 years; a large proportion are younger. The great majority, therefore, join the Army before development is completed. Recruits vary from perfect development and strength to very imperfect development. The most common defects found amongst the latter class are exaggerations of the compensatory spinal curves (cervical and lumbar) and those connected therewith, which are due to insufficient or faulty development of the trunk muscles. The latter condition is not surprising when the following facts are taken into consideration, *i.e.* (*a*) the function and size of those muscles, and (*b*) that they are naturally the first to suffer when the body is placed in an unfavourable condition for normal healthy growth.

The soldier is trained in order to prepare him for the strain and hardships of active service. He must therefore be able to march long distances and carry a load as well, and as it is necessary for him to possess good power of endurance and be healthy, and thus be placed in a favourable position to withstand the vicissitudes associated with rapid change of environment, it is essential that even the strong and well developed should receive some preparatory training.

Well-graded exercise in any system of physical training, if applied early and continued for a sufficient time, will accomplish, under normal conditions, "the harmonious development of the whole body." The Swedish system of training, thus applied in the land of its birth, is said to accomplish that object successfully, but it is necessary to recollect that only certain principles of the Swedish system have been selected to meet the necessities of the recruit type, and that their application, for those undergoing training, is limited under ordinary circumstances to a period of six months. The Swedish system of training differs in a very important respect from the one recently in operation in our Army, and, in fact, from all English systems, in that it aims at the *progressive and harmonious development of the trunk muscles;* the development, in the strict application of the term, of the muscles proper of the limbs is practically disregarded, while the aim of the English systems is exactly the reverse. In the accomplishment of this main purpose, viz., *development* of the trunk muscles, other desiderata of training are also achieved. Apart from the above special training the recruit receives instruction in marching and running on the square, and similar instruction, including digging, forms part of his later physical education after he joins the ranks

The deductions to be drawn from a review of the foregoing considerations are:—

(1) That all recruits require, at least, some physical training before they join the ranks.

(2) That the great majority require special training, and that they join at a period sufficiently early in their development to justify the belief that they will derive those benefits from the training which the system is said to afford.

(3) That the method of training in operation has a definite relation to the necessities of those for whom it is intended.

Application of the System.—Every exercise is performed from a certain position termed the "starting position." Examples of such positions are: "feet open," "feet astride," "feet sideways," "position of attention," &c. The details of these positions are given in the "Manual of Physical Training." The following points connected with them should be observed:—

(1) The angle and degree of separation of the feet should be correct.

(2) The weight of the body should be balanced equally on both feet.

(3) Balance should be maintained by the engagement of the spinal muscles when, in any movement, the point where the centre of gravity of the body normally rests is changed.

Position of Attention.—A strict adherence to the principle which it is intended in this paper to emphasise, viz., *development* of the trunk muscles, is essential. The "position of attention" occupies a very important place in the system, so in order to make clear the purpose it fulfils, the main facts contributing to the erect carriage of the body must be considered. This involves consideration of two factors: (1) The straightening or stiffening of the spinal column, and (2) the centre of gravity of the body. In standing erect, the spinal or axial muscles and those connecting the spine with the head, thorax, pelvis, and the latter with the lower extremities, are all actively engaged, the muscles of the leg and feet assisting. The centre of gravity of the body is about $1\frac{1}{2}$ inches below the top of the sacrum; a perpendicular line dropped from this when the body is erect touches the ground a little in front of the ankles, so that there is a constant tendency for the body to fall forward, and this must be counteracted by muscular action; but if the opposing muscles which pull back the body acted alone, the body would fall backward, and similarly, if the body were inclined to one side, then it would fall to that side, so that in standing erect the muscles which pull the body forward and backward as well as those which pull it to either side must be engaged in order to maintain balance.

The maintenance of balance, as is well known, is effected by engaging the spinal muscles. Native women in India are accustomed from early childhood to carry articles on their head. To enable them to accomplish this successfully the spinal column must be kept rigid and the compensatory curves symmetrical by the action of the spinal muscles. The latter muscles are in this way gradually developed, and it is common knowledge that these women carry themselves erect to a degree that is remarkable.

Standing erect, therefore, involves the calling into action of a great many muscles, and the muscular effort is increased if the heels are kept together, for the base of support is a narrow one, and the balance must be finely adjusted. The position may be said to be an unnatural one for those whose trunk muscles are not developed, but it can be accomplished by anyone, with effort, and be maintained for a reasonable time without any fear of harmful results following.

Any factor introduced, while the erect posture is maintained,

which disturbs the equilibrium of the body (balance) will increase the muscular effort required to maintain that position; such a disturbing factor is movement of the limbs. Graded exercises are therefore introduced for that purpose, and just in proportion as they disturb equilibrium so is the muscular effort to maintain the erect posture increased. In this way gradual progression is accomplished, and by *continuously* and *progressively* engaging the trunk muscles throughout the whole series of exercises, *development* of those muscles is attained. If this is accomplished to the desired degree the defects associated with insufficient development will be corrected, and a natural erect carriage will be maintained without effort.

The "position of attention" can then be defined as the posture assumed by *conscious effort* which would be maintained by *unconscious effort* if the trunk muscles were developed as Nature intended, and its function in the system becomes obvious.

Arm and Leg Exercises. — Apart from the equilibrium-disturbing influence exerted by these exercises, they also make the limb muscles proper active and the joints supple, and they enable trunk muscles, not immediately concerned in maintaining the erect posture, to be called into action. Thus, in heaving and rope-climbing exercises, the hands and elbows are so placed that the limb muscles proper are, as much as possible, thrown out of action to produce full trunk muscular effect. This introduces another important principle, viz., "economical expenditure of energy." The following illustration explains my meaning. A difficult exercise or feat of strength will quickly produce fatigue in the muscles specially used. In walking the fatigue produced is at first mainly local, that is to say, it is the muscles most used in the exercise which become fatigued. If a man climbs up a ladder on hands and feet he does a certain amount of work, but experiences no fatigue. If he climbs up the ladder by hanging on the rounds with his hands he accomplishes the same amount of work, *i.e.*, he lifts his body through the same height, but the sensation of fatigue in the muscles engaged will be severe. Though the amount of work done is the same, it is done at a great disadvantage by the small muscles of the arms instead of by the large muscles of the hip; similarly, if he raises his body with the small arm muscles instead of with the large shoulder muscles the work is done equally uneconomically.

Arm and leg movements are few and simple, and the same movements are applied to various exercises. Arm movements are classed as follows: "outward," "upward," and "forward stretching,"

"raising," "swinging," and "flinging." The leg movements are: "feet placing," "heels raising," and "leg raising" "forward" and "outward." Their chief purpose, as already stated, is to disturb equilibrium. To make this clear a few exercises will be considered. Let it be assumed the pupil is standing in the "position of attention," and receives the command "hips firm." The hands are placed on the hips in the manner described in the "Manual of Physical Training," the weight of the arms is thus transferred to the pelvis; this increases stability (*i.e.*, diminishes the tendency of the head and shoulders to fall forward). The command, "heels raise," follows. The movement is executed slowly, and as the body-weight is gradually transferred from the feet to the toes, the base of support, which was narrow at the commencement of the movement, is now narrower, and therefore equilibrium is made more difficult to maintain. Then the command "full knees bend" is given. The body, poised on the toes, is slowly lowered. When in position the pupil may receive the command, "arms outward" or "upward stretch." The movement of the arms increases the difficulty of maintaining balance, and proportionally produces developmental effect on the muscles engaged in maintaining the erect posture or "position of attention."

Again, let it be assumed that the pupil is in the "forward lying" position as described in the "Manual of Physical Training." Observe that although when so placed the body is horizontal, it should be in exactly the same position, as regards erectness, as if he were standing in the "position of attention." The command, "hips firm," followed by arms "outward" or "upward stretch" may be given. In the former position, equilibrium is disturbed to a certain extent, and in the latter more so. The pupil might also receive the command "backward bend" from the "hips firm" position, and subsequently the command, "arms upward" or "outward stretch"; the disturbance of equilibrium effected in those movements would be very much increased.

It should be apparent that these simple limb movements, as applied to the various exercises, could have no developmental effect on the limb muscles proper. But as a belief to the contrary obtains, and as the wording of para. 362 of the "Physical Training Manual" ("The object, then, of employing the muscles in all physical training and gymnastic exercises is not, as is so often supposed, merely for the sake of muscular development, which for itself alone is a matter of secondary importance, but for the effects, direct and indirect, on the harmonious development and co-ordinate

action of all the organs of the body, and of the body as a whole") may possibly lay the foundation for that belief, it may be as well to enquire into the physiological principles governing muscular exercises.

If a muscle be constantly exercised its efficiency is increased, and increased according to the call made upon it. The absolute force of a muscle, *i.e.*, the weight it is just able to lift, depends upon its cross section—that is, the number of fibres which act together in raising any weight. If, therefore, the strain on a muscle is constantly increased the muscle tends to grow and increase its cross section. Thus, if it is desired to increase the size of muscles we must ensure that these muscles are constantly exercised against a force which is greater than that which they have normally to overcome. On the other hand, ordinary exercise does not necessarily increase the size of muscles, for it is well known that many men who are able to keep up prolonged exercise have only small muscles—for example, natives of India. We may conclude, then, that exercise improves the efficiency of a muscle and its power of resisting fatigue, whilst increased strain causes increased size of the muscles and, therefore, that the arm and leg movements cannot, under the circumstances, produce developmental effect in the ordinary acceptation of the term, and further that the system as applied to the recruits, while it does aim at *development* of the trunk muscles and harmonious action of the muscles generally, does *not* aim at the *development* of all the muscles of the body.

The remaining exercises included in the system call for no comment, as the principles already indicated apply to them all.

Strict adherence to the foundation of the system, viz., *progressive development of the trunk muscles*, enables anyone to understand the objects in view and easily recognise faults in the execution of exercises. Stability is necessary if work is to be performed efficiently and economically; therefore, the muscles which maintain stability must be symmetrically developed. A little reflection will show that by judicious application of the system we possess the means, when necessary, of correcting unsymmetrical development.

It will probably be replied that everybody knows all this; then by all means let us practise what we know. It may also be replied that most of the points in this paper having direct reference to the system of training—the non-observance of which could effect its efficiency—are included in the "Manual of Physical Training," that a knowledge of the scientific basis on which it rests is unnecessary, and that the ultimate results would be the same if instructors

paid due regard and gave practical effect to the details of the exercises as they are given in the "Manual of Physical Training." While admitting the former contention, with the reservation that most of the points could be made clearer, the latter contention is liable to fail when put into practice; at least that has been my experience. It is only reasonable to suppose that instructors will take more interest in the work and discharge it more efficiently if they know what it is they are required to accomplish, and to see clearly the means by which the object in view is attained. The same remark applies equally to those undergoing instruction. There is no apparent reason for adopting a different method unless, indeed, it be that one of the objects in view is to allow instructors and recruits to reason out for themselves the *raison d'être* of the system and thus quicken their intelligence. But is that method applicable or advantageous for the recruit, in view of the facts that his period of instruction is limited, and that his intelligence is constantly put to the test in other branches of his work?

The method suggested, if adopted, would also serve the purpose of simplifying the instruction by avoiding repetition of details which are applicable to all exercises. Physical exercises are irksome and do not stimulate that enthusiasm which is associated with outdoor games and sport; they should, therefore, be made as interesting as possible, and this can best be accomplished by appealing to their personal instincts, *i.e.*, let the benefits of physical training be lucidly explained to them, teach them the ultimate purpose of the exercises, and how the latter is accomplished.

From what has been stated regarding the main purpose of the system of training and of the importance of the "position of attention" in relation thereto, it is evident if those facts are not fully appreciated by the instructors, or if they permit them to be subordinated to details of minor significance, that practically no benefit can accrue to the recruit from the system, and that "gradual progression," an important principle in all training systems, cannot exist in relation to the exercises. That being so, the following statement, which occurs on p. 26 of the "Manual of Physical Training" under the heading of "position of attention," might with advantage be modified: "It must also be noted that a recruit who has had no previous training cannot be expected to obtain this or any other position correctly at once, and that attempts to correct his positions too suddenly are certain to have injurious rather than beneficial effects. The principle of gradual, not forced or hurried, progression should, therefore, be most carefully kept

in view, and the instructor must be satisfied with any improvement, however slight, providing it is steadily and gradually maintained." This statement may possibly be so interpreted that the wording of the first sentence might in practice be carried out to an extent which would neutralise and contradict the second sentence. Attempts to correct the position of a man into one of *natural* erectness from the first, and the maintenance of that position, if really true and natural, cannot have injurious effects; whereas the impression that they will, results in instructors allowing a class to go through the primary and simple exercises without engagement of the spinal muscles, and passing men on to more advanced exercises which bring those muscles vigorously into play. A great and sudden strain is placed on the latter without having first developed them up to it by uniform maintenance of the erect posture as pre-supposed by the graduated initial exercises of the system. The result is general and physical strain, a nullification of the benefits which would otherwise accrue, and a perpetuation of the risk of breakdown and over-taxation of the heart which condemned the old system, and which the Swedish system, if accurately applied, altogether avoids. Faults to be avoided are noted against each exercise in the "Manual of Physical Training," but as the important fault, *i.e.*, disengagement of the muscles which keep the body erect, or departures from the "position of attention," applies to the whole series of exercises, it would be helpful to those engaged in the training, if a clear statement on that point was included in the "Manual of Physical Training."

The exercises as executed and taught throughout the training schools in Ireland appeared to me so unintelligible that I applied for and obtained permission to visit the Headquarter Gymnasium at Aldershot in February last. While there I was impressed by the exactness with which all the exercises were executed by those undergoing instruction, and I observed that the method of instruction was carried out by detail and demonstration. I remained at Aldershot some days and learnt that the exercises are meant to be executed correctly; but if the principles of the system, as outlined in this paper, are explained to those under instruction, one hour should suffice in order to convey a clear conception of the true and correct application of the exercises in the system.

The selection of classes under the present system whereby a recruit, told off to a squad on commencement of training, remains in that squad throughout, irrespective of his physical capabilities, might with advantage also be revised. The "Manual of Physical

Training" lays down that men of exceptional intelligence, strength, and activity are not to be transferred to more advanced classes, as such an arrangement, amongst other reasons, raises the style and tone of the whole class, and does not discourage good men by keeping them back, and does not overtax others. It is further laid down that it may be necessary to keep back weakly men under the advice of the Medical Officer, but that as the progression of physical training is so gradual and carefully arranged, this should be necessary only in very exceptional cases. If all recruits possessed approximately the same physical strength, and were as nearly as possible of the same standard of development and nutrition, the above principles might reasonably be accepted; but such is not the case, as the recruits vary on joining from very defective to almost perfect development and strength. A comparatively short course should suffice for the latter class, who might sooner than under the present system be passed fit to join the ranks, and some of the time now spent in physical training might be devoted to technical instruction. The former class requires a full course which should be graduated in exact proportion to the rate of physical progress, and the men should not be forced on by reason of the presence of stronger men in their squads to attempt to perform exercises for which they have not had sufficient practice of elementary exercises.

The "Manual of Physical Training," in dealing with heaving exercises, says that "progression in these exercises should be gradual," and "as soon as it is found possible to maintain the correct positions, the limit of the usefulness of the exercise is passed." What is the result of this? When a class under the present formation reaches the exercises in question the recruits who were stronger and well developed on enlistment perform them with ease, but those who were originally below par, and have been made to keep pace with the stronger men, fail. It is common to see weak men exhibiting signs of distress in their inability to perform such exercises. They are stopped by the instructors, placed on one side, and taken at the same exercise the following day. They again fail, but are kept going ahead with the class without deriving any real benefit, and undergoing a certain amount of harmful strain until the class they belong to completes the requisite number of attendances and they are dismissed. The failure of such men in the later tables means that they have not accurately performed the early exercises or, if they have, the time devoted to them was insufficient to produce the

required degree of development, and they should be placed in elementary classes to bring them up again gradually to the point where they failed. This is now being done with advantageous results in the Irish Command.

The formation of classes on the principle suggested would have another and far more reaching effect. It is frequently necessary to turn out battalions as strong as possible for manœuvres, mobile columns, &c., and on these occasions the whole of the recruits are withdrawn and the training consequently interrupted. On such occasions the naturally well-developed recruits do not suffer in any way by being taken away, but the weakly men undoubtedly do, and apart from the harmful effects of interruption of physical training, they are of little use in the field; and, indeed, many of them have not arrived at a state of development or strength which assures their ultimate physical efficiency and their retention in the Service certain. If, therefore, the classes were graded on a basis of physical fitness the first grade men could be taken away when required and subsequently resume the course without any evil results, and the weakly men and those requiring special management could be left to continue their exercises under closer individual supervision than it is at present possible to give them.

From the foregoing it is evident that the Swedish system of training, as applied to the recruit, is based on scientific and sound common-sense principles, but that it requires to be carried out by instructors having an intimate knowledge of its application; and that the assistance of Medical Officers, who on account of their specialised education are best fitted to guide them, is imperative if full advantage is to accrue to the recruit and to the Army. Further, that a clear and comprehensive statement as to the aim and method of accomplishment of the present system should occupy a prominent place in the "Manual of Physical Training," and so further that degree of co-operation which should exist amongst those directly and indirectly concerned in the training if the best results are to be obtained.

ANAPHYLAXIS.

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Anaphylaxis is a subject to which attention has been directed only within the last few years, but it has proved to be of such great interest and has provided such an entirely new line of research that every day those engaged in its investigation are adding to our knowledge.

Nature of the Phenomenon and Experimental Results.—Anaphylaxis is the term coined by Richet to describe the phenomenon of hypersensibility presented by animals to a second dose of a toxin. It is thus the reverse of vaccination. Richet's earlier researches were made with eel serum and the poison derived from sea anemones. In conjunction with Portier he extracted a toxin from sea anemones which he called actino-congestine, from its property when injected into the dog of causing intense congestion of all the internal organs. The maximum non-lethal intravenous dose for a dog was 0·075 gramme per kilogramme. While a dose of 0·08 to 0·1 gramme was fatal on the third day. If a dog were given a feeble dose it recovered, but on administering a second dose, even $\frac{1}{20}$th of a lethal dose (0·0025 gramme), the dog died in a few seconds with very acute symptoms—vomiting, dyspnœa, paraplegia, a profuse bloody diarrhœa, and complete anæsthesia. The intensity of the phenomenon was more strikingly brought out by noticing the dose which was sufficient to produce vomiting only ("la dose vomitive"); in a normal dog 0·08 gramme was required, whereas a dog previously sensitised required only 0·001 gramme, being therefore eighty times more sensitive than normal. The first researches of Portier and Richet date from 1902, although the phenomenon of hypersensibility had been previously noted by many observers, Behring (1893), Koch (1893), Knorr (1895), Brieger (1895), and others, and even by Majendie in 1839 (Besredka). For our more recent knowledge we are indebted especially to Richet, v. Pirquet, Arthus, Otto, Besredka, Nicolle, and the Americans Rosenau, Anderson, Gay and Southard. Two excellent reviews of the subject have recently appeared, one by Otto (*Handbuch der pathogenen Mikroorganismen*, 2, 1908), and the other by Besredka (*Bulletin de l'Institut Pasteur*, Nos. 19, 20, 21, 1908).

Anaphylaxis may be produced in animals by the administration of the sera of other animals, eggs, albumin, milk, actino- and mytilo-congestine (sea anemone and mussel poison), bacterial endotoxins, extracts of organs, extract of peas, &c., and is seen in man as the "serum sickness" ("maladie serique"—"serum krankheit"), the result of the therapeutic administration of antitoxic sera.

As the result of clinical observation it is noted that in children treated with a first dose of antitoxic serum the symptoms appear in seven to twelve days, never before the sixth (Pirquet and Schick), but that after the second dose they appear in a few hours, even with very small doses (1 cc.).

The results of animal experimentation are most interesting and may briefly be summarised. In the first place, we may define two terms used by Continental writers, viz., the phenomenon of Arthus, and the phenomenon of Theobald Smith.

The Phenomenon of Arthus (*Arthus*, 1903).—Rabbits injected subcutaneously at stated intervals with horse serum become affected after the fourth injection by a soft infiltration of the tissues, after the fifth this becomes indurated, and after later injections may even become gangrenous. The same results are obtained if the first dose be intraperitoneal followed by subcutaneous, and if an intraperitoneal or intravenous dose be given after several subcutaneous ones, grave constitutional symptoms appear and death may result. Analogous results may be obtained with milk. The phenomenon is strictly specific.

The Phenomenon of Theobald Smith.—The Americans long ago noted that guinea-pigs treated with antidiphtheritic serum were particularly sensitive to horse serum, and Otto, who through Ehrlich heard of Theobald Smith's observations, coupled the latter's name with the following phenomenon. A guinea-pig which has received many weeks before, a mixture of toxin and antitoxin of diphtheria manifests very severe and even fatal symptoms when one injects normal horse serum under the skin. Twenty-two guinea-pigs having received a dose of antidiphtheritic serum were injected subcutaneously four and a half to twelve weeks later with 6 cc. normal horse serum, soon afterwards they exhibited symptoms: accelerated respiration, dyspnœa, cardiac failure, subnormal temperature and death in half to one hour in the case of half; the other half slowly recovered. The controls (without the first dose of antidiphtheritic serum) showed no symptoms, and in fact would stand five times

the dose of normal horse serum without inconvenience. If the second dose were the serum of a rabbit, sheep, or ox, no symptoms followed. The phenomenon is therefore specific.

Subsequent experiment proved that the diphtheritic element was not necessary, though the presence of diphtheria toxin rendered the process more acute. This disposed of the hypothesis of a toxone being the cause of the symptoms.

The following facts deal with the action of normal horse serum (N.H.S.) on the guinea-pig. The condition of hypersensitiveness is produced by the subcutaneous injection of a very small dose, $\frac{1}{250}$ to $\frac{1}{1000000}$ cc. N.H.S., and requires an incubation of ten to twelve days. A second dose of 5 cc. given intraperitoneally twelve days after produces symptoms of anaphylaxis and causes death in 50 per cent. or more of cases, according to the breed of pig, as some (French) are less susceptible than others (American). If given intracerebrally the second dose need only be $\frac{1}{4}$ cc., and a fatal result is more certain. The fatal result can also be obtained by injecting 0·01 cc. direct into the heart. The state of hypersensitiveness after the first dose lasts for five months to a year, and has been known to last for 720 days (Rosenau and Anderson). It may be produced not only by inoculation but also by feeding on the serum or the flesh of the horse. The sensitising dose must be small, a large dose is less effective.

If the second dose be given before the incubation period (ten to twelve days) is over but at least twenty-four hours after the first, no symptoms, or at least very slight ones, appear, and the animal is not susceptible to a third dose given twelve days after the first. In fact, a state of anti-anaphylaxis has been produced, the animal has been vaccinated. It was found that massive intraperitoneal doses given during the incubation period protected (vaccinated) against the action of the second dose, whether intracerebral or intraperitoneal, and then that only one dose, (5 cc. intraperitoneal or $\frac{1}{4}$ cc. intracerebral) was sufficient to vaccinate, and further that the effect of the vaccinating dose was immediate, as the animal so treated could sustain a dose of $\frac{1}{4}$ cc. intracerebral given one hour and a half later. Further, it is stated that anti-anaphylaxis may be produced even after the twelve days by means of very small intracerebral doses ($\frac{1}{40}$ to $\frac{1}{400}$ cc.), and that their action also is immediate.

The intraperitoneal method of vaccination is said to give a more solid protection than the intracerebral, but the severity of the cerebral operation may reasonably explain this. The vaccinated state

lasts for months, very much longer than that conferred by antitoxic or antibacterial sera. Nor can this anti-anaphylactic immunity be transmitted to another animal, none of the organs, brain, spleen, liver, or serum, possess any specific property. These facts are brought forward to support the idea that this immunity is of the nature of a desensitising, a recurring to the normal state. Animals rendered anti-anaphylactic by means of large doses are at a later period found to be hypersensitive, and their young born during the anti-anaphylactic period are also hypersensitive. This has been explained by supposing that the excess of the immunising dose over what is required to produce anti-anaphylaxis (neutralisation) subsequently acts like a first dose in a normal animal.

The anaphylactic state can be transmitted to the young *in utero*, but not through the male or through the milk. It is, however, inconstant, and the individuals of the same litter vary in degree and in duration of sensitiveness.

It would appear that anaphylaxis requires the intervention of some special cells for its production, as it cannot be produced by intracerebral injection.

The nature of the anaphylactic principle of the serum is still a matter of doubt, but it seems probable that it is a protein. Non-protein substances, such as cocaine and apomorphine, do not produce anaphylaxis, while all the higher forms of albuminous substances, no matter from what source, are capable of producing sensitising and intoxication effects. Although there is evidence that the production of precipitins bears some relation to the anaphylactic state, the anaphylactic principle does not exhibit the phenomenon of fixation of complement, and is therefore not of the nature of a precipitin.

Rosenau and Anderson state that it is not acted on by ammonium sulphate nor by the ferments—taka-diastase, pancreatin, invertin, pepsin, rennin, myrosin, emulsin, but Gay and Adler find that the precipitate (euglobulin) obtained after adding ammonium sulphate to horse serum to a third of saturation is actively senitising but non-toxic. The protein precipitate on subsequent fractions obtained by addition of ammonium sulphate to saturation has less and less sensitising power and gets progressively non-toxic, but the sensitising power is not completely lost; while Gideon Wells finds that in tryptic digestion of ox serum both the sensitising and toxic properties are gradually lost as the coagulable portions of the serum disappear.

The anaphylactic principle does not dialyse through a collodion

sac, and is not touched by formic aldehyde, in contradistinction to the toxins of diphtheria and tetanus.

The following agents have no action: atropine, morphine, strychnine, caffein, calcium chloride, magnesium sulphate, butyric acid, permanganate of potash, citrate of soda, ether, alcohol, chloroform, peroxide of succinic acid and of hydrogen, tricresol, Gram's fluid, animal charcoal, ox-bile, freezing and thawing, and X-rays.

Gideon Wells has obtained a pure protein from egg white by means of repeated crystallisation. He finds that this produces anaphylactic symptoms and is much more active than unpurified egg white. The sensitising dose is only $\frac{1}{20000000}$ gramme; and for a fatal result $\frac{1}{10000000}$ gramme; the minimal lethal dose is $\frac{1}{2}$ milligramme intraperitoneally, or $\frac{1}{10}$ to $\frac{1}{20}$ milligramme into the circulation. He argues that the minuteness of the dose indicates that the sensitising and the toxic portions are one and the same kind of protein molecule, or else two different parts of the same molecule.

Gelatine is devoid of anaphylactic power, because of its poverty in aromatic radicals.

Coagulation of proteins by alcohol which renders them insoluble (viz., egg white) destroys toxicity, but not of those which it does not render insoluble (serum). Iodisation of serum does not yield constant results.

The Effect of Heat.—Heating at 60° C. for six hours does not destroy. Heat at 100° C. for twenty minutes (one part serum and three parts distilled water to prevent coagulation) renders a lethal dose ($\frac{1}{4}$ cc. intracerebral) inoffensive to a sensitive animal. That the toxic element of the serum is destroyed is proved by the subsequent (one and a half hours) injection of unheated N.H.S., when the animal is just as sensitive to the test as the controls, though perhaps there may be a delay or diminution in the severity of the symptoms. The same is true if the heated serum be injected intraperitoneally (5 cc.). But if the period between the injection of heated serum and that of the lethal dose be increased beyond twenty-four hours to four, five, or six days, only mild symptoms (cough, excitement) follow. Therefore a certain immunity is conferred by serum heated at 100° C. in four to six days, proving that not all of the toxic principle is destroyed.

At 76° C. the toxicity is slightly decreased. It may be laid down that both the toxicity and the vaccinating power diminish as a temperature of 100° C. is approached. But much lower temperatures may be shown to have a marked effect. If a serum be heated to 56° C. for one hour on three successive days, and on the

fourth for two hours it becomes three times less toxic than the same serum unheated.

Seeing that the toxin is thermolabile it would be expected to produce an antibody. But this is not the case, as the blood of an immunised animal mixed with and injected along with N.H.S. does not hinder the toxic effect of the serum (Besredka). While the toxic property is destroyed by heat, it is otherwise with the sensitising N.H.S. heated to 100° or 120° C., which does not suffer any decrease in its sensitising property, indeed it is stated to be, if anything, increased. This fact Besredka brings forward in support of his theory that serum consists of two substances, one thermostable (sensitising), the other thermolabile (toxic).

Milk heated at 100° C. for fifteen minutes loses neither its sensitising nor its toxic property. Crystallised egg white heated at 100° C. for fifteen minutes does not lose all the sensitising power, but its toxic property is almost entirely destroyed at 90° C.

The Effect of Narcotics.—The symptoms of anaphylaxis are supposed to be due to a toxic action on the cells of the central nervous system, whereby they are subjected to a severe shock, and some support is lent to this view by the fact that certain narcotics are capable of preventing these symptoms.

If a sensitised animal be etherised and then immediately injected with a lethal dose it presents no symptoms on waking in half an hour. But further, if another lethal dose be given the following day again no symptoms supervene, therefore the animal has been vaccinated. Ethyl chloride and chloral hydrate are said to give the best results. Opium and morphine have practically no effect. Urethane merely gives a respite for sixteen hours.

Theories to explain the Phenomenon.—There is as yet no satisfactory explanation of the phenomenon. But of course many theories have been suggested. The majority of observers favour the idea that an antibody is formed and Nicolle states that he has succeeded in demonstrating it. Others—especially Gay and Southard—oppose the theory. Vaughan and Wheeler think that a ferment is formed after the first injection which acts on the albuminous substance at the second injection, splitting it up into two parts, a toxic and a non-toxic.

Besredka finds that two properties (sensitising and toxic) of the serum may be distinguished by the action of heat, the sensitising property is thermostable and is due to a substance which he calls "sensibilisogene," and which produces "sensibilisine" after twelve days. The toxic property is due to "antisensibilisine," a thermo-

labile substance which combines with the "sensibilisine" whether it be free or fixed to a nerve cell. The effect of etherising is to render the cell non-sensitive to the shock of disruption of the "sensibilisine."

Practical application of the Phenomenon.—It is evident, therefore, that the facts elicited by a study of this subject fall into line with recent modifications in our views on immunity. Koch long ago pointed out that tuberculous patients were hypersensitive to tuberculin, and it is now generally recognised in the treatment of bacterial disease by vaccines that a dose which would be necessary to evoke a response in a normal individual would be much too large for an infected (or sensitised) one and would probably cause a dangerous negative phase. Not only in treatment, but also in prophylactic inoculation of vaccines, evidence is forthcoming that hypersensitiveness plays an important part in the subsequent immunity.

Serum Sickness. — From the point of view of practical therapeutics—the administration of antitoxic sera—the importance of anaphylaxis is now being appreciated. Everyone is familiar with the symptoms of serum sickness which so often follow the administration of a dose of antitoxin serum and rarely appear before the sixth day, but not everyone has grasped the fact that a person once treated with horse serum is for years (perhaps for life) rendered hypersensitive to a second injection.

This hypersensitiveness is evidenced by the appearance of anaphylactic symptoms in an accelerated and aggravated form. Three interesting cases in the persons of medical men are reported in the *British Medical Journal*, January 18th, 1908 (Thorne), February 29th (Bligh), April 18th (Waterhouse); in one case there was an interval of four and a half years between two doses. The effects may be so severe as to cause death. Gorstein has collected twelve cases and Rosenau and Anderson nineteen.

According to Goodall, the susceptibility to a second administration is increased in proportion to the quantity of serum used, and to the serum reaction in the first instance.

While personal idiosyncrasy is no doubt a factor in determining the severity of the symptoms of serum sickness a none the less important one is the particular horse serum used. Some sera are undoubtedly more toxic than others (Washburn, Card, Goodall), and Besredka points out that the age of any particular serum has also to be reckoned with. A particular serum was lethal to a sensitive guinea-pig in $\frac{1}{32}$ cc. dose when freshly drawn; when seven

days old the lethal dose was $\frac{1}{16}$ cc.; on the forty-fifth day $\frac{1}{16}$ cc.; and from two months to one year old $\frac{1}{4}$ cc. A serum kept by Roux for thirteen years was lethal in $\frac{1}{4}$ cc.

Besredka recommends that all sera should be tested as to their toxicity for guinea-pigs before being used therapeutically, and that a serum which kills a sensitised guinea-pig in a dose of $\frac{1}{20}$ cc. should be avoided. It will therefore be recognised that great discrimination is necessary in the selection of cases for treatment by antitoxic sera. It will be as well to carefully enquire into their past medical history for diphtheria and septicæmia which may have been treated by serum.

It is probable that when the dangers of anaphylaxis become more widely and generally appreciated the prophylactic administration of antidiphtheritic serum will not be undertaken so lightheartedly as it frequently is.

It might be of advantage to consider the preparation of antitoxic sera from another suitable animal besides the horse for use in cases which have been sensitised to horse serum on some previous occasion.

ON THE SPECIFICITY OF THE THERMOSTABLE OPSONINS FOR STREPTOCOCCI.

By Major W. S. HARRISON and Captain L. W. HARRISON.
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Although it is now generally recognized that streptococci comprise a group of possibly very various organisms, it is very doubtful if any very satisfactory method of differentiating one member of the group from another has been evolved up to the present. The well-known sugar and other cultural reactions which were worked out by Gordon, and elaborated later by Andrewes and Horder, have given, in the hands of one of us, the most discordant results. Agglutination phenomena with streptococci are notoriously irregular, whilst it has hitherto been found impossible to demonstrate any bactericidal action of immune sera on streptococci. It appeared, therefore, desirable to attack the question from another standpoint, and it seemed possible that a study of the thermostable opsonins resulting from the injection of streptococci might give some further information on the subject.

A number of streptococci were isolated from normal throats, from sore throats, and from a tonsillar abscess, as well as from a case of acute pyæmia, a case of erysipelas, and from a case of traumatic lymphangitis. A list of these, together with their principal reactions, is given in Table I. Living cultures of a number of these strains were injected into rabbits, each animal receiving one strain of streptococci only; the doses were given at intervals of about ten days, the first dose in each case being given intravenously, the later ones subcutaneously. Although some of the cultures were freshly isolated from suppurative foci in man, in no case did the animal seem to suffer any serious inconvenience beyond, in one or two instances, a small nodule at the point of inoculation. After a suitable interval experiments were made to find out whether the sera of the immunised animals contained thermostable opsonins for the cocci with which the rabbits had been inoculated, and, if they did, whether these opsonins were active for other streptococci. The technique adopted was as follows: The sera were heated to 60° C. for half an hour, after which mixtures of heated serum, washed blood corpuscles (human), and a thick emulsion of a twenty-four-hour agar culture of streptococcus were taken up in capillary

TABLE I.

	Morphology of chains	Broth	Milk	N. red	Sacch.	Lactose	Raffinose	Inulin	Salicin	Coniferin	Mannite	Maltose	Hæmolysis	Origin
J2 ..	Very long chains in pairs	Flocculent deposit	−	−	±	+	−	−	−	−	−	−	0	The same normal throat
J9 ..	Lanceolate diplococci and small chains	Ditto ..	Clot	−	−	−	−	−	−	−	−	−	0	
J11 ..	Mostly round diplococci and short chains	Diffuse ..	−	−	+	+	+	+	+	+	−	+	0	
V7 ..	Very long	Conglomerate	Acid	+	−	−	−	−	−	−	−	−	0	Tonsillar abscess
H ..	Long ..	Flocculent deposit	Clot	+	+	+	−	±	−	±	−	+	0	Traumatic lymphangitis
Hks	Short ..	Diffuse ..	Ditto	−	+	−	−	−	−	−	−	+	+	Scarlet fever throat
G6 ..	Very long	Flocculent deposit	Ditto	−	+	+	±	±	−	+	−	+	+	Normal throat
Br19	Short ..	Diffuse ..	Ditto	−	+	+	−	−	−	Olive-green	−	0	+	Ditto
Br16	Ditto ..	Ditto ..	−	−	+	+	+	−	+	+	−	+	−	Ditto
St13	Ditto ..	Ditto ..	−	−	+	−	+	−	+	+	−	0	0	Ditto
M10	Short to medium	Ditto ..	−	−	+	−	+	+	±	−	−	0	Light green	Ditto
Co18	Ditto ..	Ditto ..	Clot	−	+	+	−	±	−	−	−	0	+	Ditto
Br9..	Ditto ..	Ditto ..	Acid	+	+	+	+	+	+	−	−	+	0	Ditto
Br4..	Short ..	Ditto ..	−	−	+	+	+	+	−	−	−	−	0	Ditto
G1 ..	Long ..	Heavy flocculi	Acid	+	+	+	±	±	−	−	−	+	+	Ditto
Co10	Ditto ..	Diffuse ..	Clot	−	+	+	+	−	−	−	−	0	−	Ditto
Ca11	Short to medium	Light flocculi	−	−	+	+	+	−	−	−	−	0	0	Ditto
A2 ..	Large diplococci and short chains	Granular ..	Clot	−	+	+	−	−	+	+	−	0	0	"Sore throat"
Co17	Long ..	Heavy flocculi	Acid	−	+	+	−	−	−	−	−	0	+	Normal throat
E2 ..	Medium	Flocculent deposit	Ditto	−	+	−	−	−	−	−	−	+	+	Case of erysipelas
E3 ..	Ditto ..	Ditto ..	Ditto	−	+	−	−	−	−	−	−	+	+	
L1 ..	Long ..	Ditto ..	Ditto	−	−	+	−	−	−	−	−	+	+	Pus from pyæmic abscess

+ = Acid; − = No change; 0 = Not tried.

tubes; these were incubated in a water-bath at 37° C. for fifteen minutes; films were then made and stained by Leishman's stain. In examining the films fifty cells at least were looked over, but no attempt was made to count the number of cocci in each phagocyte, since the only object of the experiment was to determine whether the serum contained thermostable opsonins for the coccus with which it was put in contact or not. This point was very easily settled in all but a couple of instances, since there was either no phagocytosis at all, beyond occasionally a few cocci in one or two of the fifty cells examined, in which case thermostable opsonins were deemed to be absent; or else practically every cell was packed with cocci, when it was assumed that thermostable opsonins for those particular streptococci were present in the serum.

TABLE II.

Cocci	Heated normal serum	Heated Sera of Rabbits Immunised with								
		J2	J9	J11	H	V7	Hks	G6	Br19	Br16
J2	0	+	0	0	0	0	–	–	–	–
J9	0	0	+	0	0	0	–	–	–	–
J11	0	0	0	+	0	0	–	–	–	–
H	0	0	0	0	+	0	–	–	–	–
V7	0	0	0	0	0	+	–	–	–	–
Hks	0	0	0	0	0	0	+	–	–	–
G6	0	0	0	0	0	0	0	+	0	–
Br19	0	0	0	±	–	–	–	0	+	0
Br16	0	0	0	0	–	–	–	–	–	+
St13	0	0	0	0	–	–	–	–	–	–
M10	+	+	+	+	–	–	–	–	–	–
Co18	0	0	0	0	–	–	–	–	–	–
Br9	0	0	0	0	–	–	–	–	–	–
Br4	0	0	+	0	–	–	–	–	–	–
G1	0	0	0	0	–	–	–	–	–	–
Co10	+	+	+	+	–	–	–	–	–	–
Cal1	0	0	0	±	–	–	–	–	–	–
A2	+	+	+	+	–	–	–	–	–	–
Co17	0	–	–	–	0	0	–	–	–	–
E2	0	0	0	0	0	0	–	–	–	–
E3	0	0	0	0	0	0	–	–	–	–
L1	0	0	0	0	0	0	–	–	–	–

\+ = Phagocytosis. 0 = No phagocytosis.

The results obtained are given in Table II., which represents the collected results of a very large number of frequently repeated observations. It will be seen that each serum contained thermostable opsonins for the coccus with which the rabbit providing it had been inoculated, and for no other except in cases where the heated

normal serum also produced phagocytosis. The only exception to this was in the case of serum J9, which produced phagocytosis of coccus Br4; unfortunately this strain died out before we were able to carry out the further experiments which the finding suggested. In the case of serum J11 there were two doubtful results, the only ones in the series; they were probably due to the fact that this serum was one which produced extreme agglutination of human blood cells. The rabbit which provided it died at a late stage of the proceedings, and was found to be very intensely infected with coccidiosis.

It appears, then, that the injection of streptococci into rabbits results in the production of thermostable opsonins which are extremely specific, so much so that our earlier hopes that one might perhaps be able to use the principle as a basis for the classification of streptococci have declined considerably; for it is evident that streptococci must form a group of a very large number of organisms differing among themselves as much or more than typhoid bacilli differ from the other members of the coli group. We propose, however, to continue the research from this point of view.

The more immediately practical bearing of the results seems to be that it is very necessary, in the vaccine therapy of streptococcus infections, to use a vaccine prepared from a culture of the germ from whose activities the patient is suffering, a point which has been already recognised, chiefly on clinical grounds. It also seems possible that the indifferent success which has followed the use of anti-streptococcus serum may be due to the fact that it is prepared by the injection of organisms which only by a lucky chance are able to produce opsonins active for the streptococci which are causing the trouble.

EARTHQUAKE RELIEF PARTY OF THE ROYAL ARMY MEDICAL CORPS, CATONA, JANUARY, 1909.

By Captain H. S. ANDERSON.
Royal Army Medical Corps.

A severe shock was felt at Malta about 5 a.m. on December 28th, 1908. Two and a half hours later a tidal wave rose in the harbours to a height of 7 feet. It flooded the road at the end of the Pietà creek and entered some of the houses. The flood continued at this high level for almost eight hours, and when the waters receded many small fish were found gasping in the mud. In the evening these phenomena were explained by wireless reports of the great earthquake in Sicily.

H.R.H. Field-Marshal Commanding in Chief issued orders at 7 p.m. on the 29th for a party of the Royal Army Medical Corps to prepare for embarkation.

The Principal Medical Officer detailed Major Crawford to command, selected the *personnel*, and arranged as to equipment, rations, &c.[1]

By 3.30 p.m. on the 30th all was ready at the place of embarkation, and at 8 a.m. on the 31st the party was inspected by H.R.H. Commanding in Chief.

Embarkation on H.M.S. "Duncan," flagship of Admiral Callaghan, began at 9.30 a.m., and, with the assistance of thirty men of the 2nd Battalion Somerset Light Infantry, was complete by 1.30 p.m. Additional food supplies and an Army Service Corps Field Bakery section were embarked later. H.R.H., accompanied by H.E. the Governor, came on board, and after a final inspection, the battleship sailed at 5.15 p.m.

Our first sight of the scene of the disaster was from the deck of the flagship H.M.S. "Duncan," at sunrise on New Year's Day. Snow lay on all the hills on either side of the Straits. In the distance the white buildings of the coast towns looked much as usual, but through the glass, when the sun had risen higher, one could make out piles of *débris* and solitary walls standing out of the wreckage. We advanced slowly, with soundings all the time. When Messina came into view white walls again deceived the eye, but

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[1] The *personnel* was a Field Ambulance section; the equipment a Stationary Hospital with special stores; rations with special extras were for ten days.

behind them, at various points in the town, isolated columns of smoke were rising.

The anchor was let go in the roads outside the harbour, off the horn of the spit of land which is the famous "sickle" of antiquity. Between us and the beach two passenger steamers were taking people on board; the nearer one, a fine vessel of the Florio-Rubattino Line, was soon completely filled, and steamed out north. The cutters and pinnace of H.M.S. "Sutlej" were busy removing wounded from the shore to the ship, and all our medical officers were soon employed on board her. The patients were being dressed and tenderly cared for; mattresses, blankets, and warm comforts were provided. Cigarettes were issued and were particularly appreciated even by many of the more serious cases.

While waiting on the "Duncan," one noticed the absence of local small craft; in fact, only one rowing boat was visible and it contained four miserable-looking men and a boy, who came near to beg for bread, saying that they had been without food for four days. One heard, from time to time, detonations and occasional rifle shots in the city. Along the sea-front large numbers of people were scrambling aimlessly to and fro, over the heaped up *débris* in the streets; others were gathered in groups, and through the glass one saw that the largest crowd was close to the Red Cross flag, which marked the dressing station of H.M.S. "Minerva."

To the south, in the soft low-lying ground of the "sickle"-shaped spit, a party of sailors, said to be Russians, were burying the dead brought thither by other sailors.

The masts of a Russian cruiser and other foreign warships lying within the harbour showed that our view was only a partial one, though more than sufficient to make it clear that all the buildings were mere shells.

About two hours before sunset the boats of H.M.S. "Duncan" touched the Catona beach, where desolate men, women, and children were assembling to meet the "Inglesi." Headed by a ship's party with picks and shovels, we were shown the way to the railway station enclosure, in which a wooden shelter had been erected by the Italian troops for the reception of seriously wounded cases. Here the Royal Army Medical Corps advance party, consisting of medical officers and nursing orderlies, formed a dressing station and worked until long after dark. When this party arrived, the doctor of the neighbouring village of Salice was rendering what assistance he could, though himself badly wounded. Next day he became an out-patient, and it was found that he had an enormous

suppurating scalp wound and a fractured left parietal bone, as well as severe contusions and wounds in other parts of his body. It was said that three doctors were killed in Catona; one of them was found later uninjured in bed, having been smothered in his last sleep.

Catona lies between the sea and the railway from Villa San Giovanni to Reggio-Calabria, about 3 kilometres south of the former. The population was fully 4,500 and almost one-half were buried in the wreckage. Most of the civic officials and professional men were dead. The houses were made of rubble and very sandy mortar, and in the long main street, where they were three storeys high, the ruins completely blocked the road. Broken chairs, solid furniture crushed to matchwood, and twisted iron beds bore witness to the terror of the disaster. Very few buildings were still standing, all of which were badly cracked.

The only available clear space for the hospital lay north-west of the town. It had been a market-place and was on a gentle slope of gravel and sand, reclaimed from a river-bed. The north-east part, as the driest, was assigned to the field bakery. A well was close by, and the only building, a municipal office, served for storing flour and preparing "sponge."

We returned to the ship, and before turning in for the night all the officers assembled to hear the orders for disembarkation. The Commander of H.M.S. "Duncan" rapidly and concisely arranged the details and satisfied himself that those concerned understood them. On January 2nd, at 7 a.m., the "Duncan" weighed to Catona, and on arrival the first tow (four cutters) was got ready to take working parties of sailors and marines, together with thirty of the Royal Army Medical Corps, including the serjeant-major, dispenser, sanitary orderlies, and cooks. The water-cart and filters, cook-house equipment, operating tent and equipment, and pioneer tools were stowed for landing first. As an instance of the way in which the Royal Navy expedited the opening of the hospital, it may be mentioned that the Captain of H.M.S. "Duncan" provided a cooked meal, sufficient to last for twelve hours, for every man going on shore, and an ample supply of pure water was landed from the ship. E.P. tents, stores, and tent equipment were landed during the morning. Our Quartermaster remained on board until he had seen the last articles ready for the shore. The stores had to be carried more than 300 yards over sandy ground, and the sailors found that the water-cart carriage was very serviceable.

Before leaving Malta, rations and supplies for a second period of ten days had been drawn, and these were disembarked in the afternoon.

Two sisters of the Queen Alexandra's Imperial Military Nursing Service and two volunteer nurses from Malta were attached to the Hospital Staff, as the Admiral found that they could not work so profitably elsewhere. They disembarked early in the forenoon.

As soon as the operating tent and dressing (E.P.) tent were up, a working party of Royal Marines took over the pitching of tents.

N.C.O.'s of the Nursing Section were detailed as ward-masters of the two divisions, male and female.

Fig. 1.—Catona. About noon on January 2, 1909.

It was their duty to report deaths to the Serjeant-Major at once, and on going off duty at 6 p.m. to hand him a list of the actual numbers of admissions, discharges, and of patients for each tent. An officer visited each ward between 6 and 7 p.m., and noted the numbers independently, afterwards checking the ward-masters' lists collected by the Serjeant-Major.

Equipment for twelve beds was drawn for each E.P. tent when erected, and a nursing orderly placed in charge.

Empty boxes for dry rubbish and biscuit tins for liquids were placed close by the tents, and removed and emptied as required by the sanitary party.

Deep latrines were dug in the sandy soil and shored up with old

boards and transverse struts. The trenches were narrow, and the users straddled across them. Urine soak-aways were dug close to the latrines.

A field incinerator and a refuse pit were placed outside the camp.

An ablution stand and a tarpaulin bath for the N.C.O.'s and men were erected south-east of the camp.

The water was from a surface well and filtered before use.

The field kitchens, of tufa blocks from the ruins, worked well, and before the rain came were roofed with tarpaulin.

Fig. 2.—Hospital Staff of the Earthquake Relief Party, R.A.M.C.

On the 2nd, rescue parties from the "Duncan" went out early and worked steadily until late, the last of them returning in the moonlight about 11 p.m. This squad had sent to camp four hours earlier for a saw and also for assistance in excavating an old man. Volunteers were called for, and the Officer commanding the Marine Guard went out with our interpreter, one N.C.O., and four men of the Royal Army Medical Corps. The work appears to have been arduous, and was rendered more exciting by loosened stones and mortar dislodged above the rescuers by a good six-second "scossa" (shock). The parish priest of Catona was among the first to welcome us, and gave us very great assistance by his cheerful influence with the sorrowing and panic-stricken sufferers. His house, in collapsing, had killed about fifteen people, but left him

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Rough Plan of British Camp. Catona. Jan. 1909.

CATONA STATION

To Catona

From Villa S. Giovanni RAILWAY on Embankment

BRIDGE One Arch

To Catona Town

LEMON TREES

Tarpaulin Bath

Well

LEMON TREES

Well

Winter Sown Barley

Wall, much damaged

SOAK PIT

LEMON TREES

Wall, much damaged

TIMBER YARD

Wooden Fence

Broken Boats

South

E

W

NORTH (Approximate)

CONVALESCENTS

OFFICERS' TENTS

Water

Filters

Cook House

Cooks

Duty Tent

NURSES

Women

Men

GUARD

BIVOUAC (Italian)

BAND STAND

Officers' MESS

R.A.M.C.

Steward's STORE

Ovens

TOWER

A.S.C.

Q. Ms. STORE

OFFICE

Well

Stores under Tarpaulin

Wall

OPERATING TENT

DRESSING TENT

KITCHEN

DISPENSARY

A.1. B.1 D.1.

A.2. B.2 C.1. D.2.

A.3 B.3 C.2. D.3

E.1. F.1.

ISOL.n

E.2.

UTENSILS

E.3

Excavations for Gravel

MORTUARY

1st Position

SANDY BEACH with GRAVEL (alluvial)

STRAITS OF MESSINA

BRIDGE Three Arches

OLD RIVER BED, DRY.

LATRINES

Convalescents Officers Female Pat. Male Pats R.A.M.C

Wall

ORANGE GROVE

INCINERATORS

MORTUARY

Final Position

TALL GRASS

Approximate Scale of Yards

0 10 20 30 40 50 60 70 80 90 100 150 200

Yards

unhurt. He lived in hospital for the first few days, and during our stay was always ready to come at short notice. He placed doctor and patient in complete accord within a few minutes, without the excited hand-waving chatter so hopelessly unintelligible to a foreigner, and trying to the nerves of some. He was told, "Padre, operatio in somno sine dolore necesse est," and he understood that an anæsthetic was required. In the case of an amputation, after his explanation the patient would ask "Dove?" and there might be a quiet pleading for the lowest possible point, but confidence in the surgeon's judgment had been established by the padre.

Fig. 3.—Catona. Looking east from the direction of the incinerators.

Just before the first case was treated, we all stood by our work for the space of about one and a half minutes while the padre said a short prayer for God's blessing on our efforts.

Within two hours there were two wards (tents) full of female and one of male patients, but at no time was there any delay; a bed was always ready when a patient was admitted.

The general procedure was :—

All cases, on arrival at the camp, were first taken to the dressing tent. There hot bovril and other comforts were administered immediately. Each case was examined, dressed, and, if admitted,

sent straight to a ward with a descriptive tally (A.B. 166). Slight cases were allowed to attend for dressings, unless they were unable to obtain food and shelter outside the hospital. No one desiring admission was at any time refused.

Inside the dressing tent two tables were erected for examination of the serious cases. Along one side of the tent seats were made, by means of planks placed on biscuit boxes, for accommodation of the slighter cases. Just outside the tent a fire was kept going in a field kitchen, with kettles for bovril, boiling water for fomentations, &c.

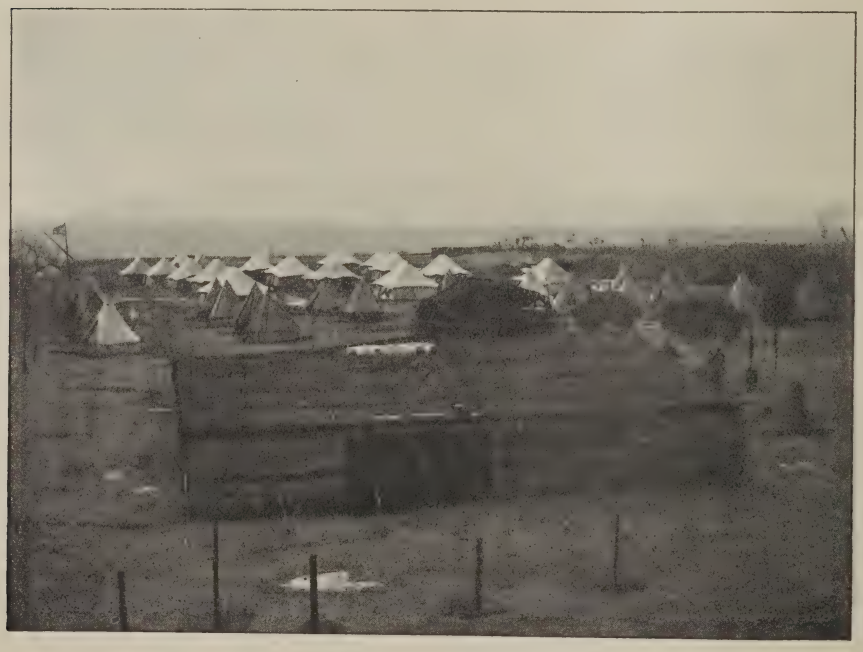


Fig. 4.—Catona. Convalescent hut in foreground; band-stand covered for chapel; incinerators in background.

The variety of injuries met with was extraordinary. Almost every case was complicated by severe contusions and abrasions. Compound fractures, always septic, were very common, especially of the lower limbs, and many of them were gangrenous. The commonest fractures were those of the tibia and fibula; next to these, of the femur. Most of the fractures were on the left side. There were several cases of fracture of the pelvis and spine. It

was noteworthy how comparatively rarely the bones of the upper extremity were injured. There were, however, over twelve simple fractures of the humerus, and a few fractures of the forearm. Only one compound fracture of the upper extremity was met with, and it ended fatally. One patient came in with fracture of the acromion end of both clavicles, but absolutely refused to remain in hospital, although strongly urged.

The best splints were made from the ration biscuit boxes. Each box gave material for six good-length leg-splints with foot-pieces, which were nailed on and strengthened at the angles with perforated zinc.

The most satisfactory bandages were of calico, cut and rolled in the dispensary, where an excellent roller was improvised with a pencil and a tobacco tin.

Dislocations were, on the whole, uncommon. The majority were of the shoulder, and about half of these were fracture-dislocations, the rest being of the ankle, knee, wrist, elbow, &c. Wounds were extremely common, usually multiple, and suppurating. Very extensive scalp wounds were particularly common, and in many cases presented an extraordinary appearance, large areas of bare bone being exposed, and the whole wound quite dry and encrusted. Boric fomentations produced wonderful results towards rapid healing in these cases.

The principal injuries were fractures of extremities: Simple, fifty-seven; compound, thirty-seven; of pelvis or spine, ten. In seventy-five wounds of head and face there were compound fractures of skull, four; of lower jaw, one; and wounds of eyeball, four.

Only two cases were admitted with burns, and in neither case were the burns the chief lesions. There were several cases of paralysis of the lower extremities, with incontinence of urine and fæces. Many other cases with varying degrees of partial paralysis were met with, most of whom rapidly recovered.

Constipation was general, and treatment was not always effective at once. One case of interest may be cited. A man was admitted with extreme distension and rigidity of the abdomen; there was a history of eight days constipation. Treatment by drugs and enemata had no effect for four days, but for the next three days semi-solid fæces were passed almost continuously, and his abdomen rapidly resumed its normal size.

Two cases were admitted with acute pneumonia, and three cases developed septic pneumonia in hospital. All five ended fatally.

Inanition from prolonged burial and starvation was diagnosed

in cases where no actual lesion could be discovered, and most of these recovered with careful nursing and feeding. It was remarkable how some of these cases, who had been entirely buried in the ruins for five to seven days, lived on with subnormal temperature and practically pulseless for four to five days before they succumbed.

Tetanus was first seen on the afternoon of January 4th (eight days after the catastrophe) in a woman admitted on that day with general abrasions and trismus. She rapidly developed general spasms of increasing severity, with well-marked opisthotonos, and died within twenty-four hours. Seven other cases occurred with the following incubation periods : One on tenth day, one on eleventh day, two on twelfth day, two on fourteenth day, one on fifteenth day. Six of these cases were suffering from traumatic gangrene, four of whom had one of their limbs successfully amputated. This was particularly disappointing, as they had stood the operation well, and were making good progress when symptoms of tetanus developed.

With the exception of the first case, none showed marked opisthotonos ; trismus and cervical retraction being the prominent symptoms. Chloral and bromide were the drugs chiefly used, and all possible local foci of infection were drastically treated. A limited supply of anti-tetanin (Tizzoni) was received and injected without success. All cases proved fatal, and ended somewhat suddenly from asphyxia. One died at an early stage from intercurrent septic pneumonia. The average duration after the onset of symptoms varied from one to four days, but one case survived for nine days.

Ten amputations were performed, in every case for traumatic gangrene of the lower extremities. The average time from first incision till the wound was sutured was ten minutes. These patients stood the operation remarkably well, shock being practically absent. Unfortunately, four of them developed symptoms of tetanus shortly after operation, and died. We considered that this result was due to the large amount of tetano-toxin formed in the original wound, and absorbed prior to operation, rather than to continued absorption of toxin from abrasions elsewhere.

There were many more cases urgently needing operation, but consent could not be obtained, and a few cases arrived with gangrene too far advanced. Only one amputation was done by artificial light.

The anæsthetic used for all operations and difficult dislocations was chloroform on lint ; administration was easy, and there were no troublesome after-effects.

AMPUTATIONS.

	Sex	Age, Years	Date admitted	Date of operation	Injuries	Notes
			Jan.	Jan.		
1	F.	1¼	2	2	Compound fracture both bones left leg	Died; shock, Jan. 3rd.
2	F.	25	2	3	,, ,, ,, ,,	Died; tetanus, ,, 15th.
3	F.	32	2	3	Multiple abrasions; compound fracture left foot	Died; tetanus, ,, 15th (symptoms 9 days).
4	F.	55	2	3	Debility ; compound fracture both bones left leg	Doing well ; transferred on Jan. 15th.
5	F.	45	2	3	Debility ; compound fracture both bones left leg	Stump healthy ; sudden collapse; died Jan. 6th.
6	M.	40	3	4	Hectic and great debility; compound fracture both bones left leg	Doing well; transferred Jan. 15th.
7	M.	60	4	5	Compound fracture both bones left leg	Died 12th ; septic pneumonia ; tetanus symptoms Jan. 11th.
8	F.	44	2	5	,, ,, ,, ,,	Doing very well; transferred on Jan. 15th.
9	M.	45	6	6	Septicæmia ; compound fracture both bones left leg	Died; tetanus, Jan. 9th.
10	M.	10	7	8	Hectic ; compound fracture both bones left leg	Doing well ; transferred on Jan. 15th.

During the short time that the hospital was open, several general cases, unconnected with the earthquake, came for treatment. The number of these increased towards the end of the period, some coming from distant villages with notes from the local doctor. These included: Ischio-rectal abscess ; suppurating buboes and venereal sores ; heart disease ; carcinoma of the breast ; spinal caries ; tubercular osteitis of femur ; dental caries (for extraction), &c. One case of strangulated hernia was admitted, but, unfortunately, operation was declined.

The 35 deaths are classified as : males 14, females 21 ; due to septicæmia, 8 ; tetanus, 8 ; multiple injuries, 4 ; fractures of pelvis and spine, 4 ; compound fracture of limbs, 4 ; inanition, 3 ; pneumonia, 2 ; shock, 1 ; and general peritonitis, 1.

The health of the *personnel*, on the whole, was remarkably good. The most prevalent complaints were septic fingers and septic sore throats ; the latter quickly resolved when treated with formalin gargle, freshly made, and generally used somewhat strong, *i.e.*, about 1 in 120.

Nursing in the tents, where so many were bedridden, was very laborious and nauseating, and ignorance of the language made it very difficult to recognise promptly what the immediate wants of the patient were. After three days, however, many of the men understood their patients better than visitors who spoke cultured Italian fluently. Knowledge of Horace is not needed to explain the frequent "cacare" or "cacatura," which the orderly soon learnt was a call for the bed-pan. "Sto moriendo di freddo" was answered by an extra blanket, but very frequently meant a desire to have the tent doors closely adjusted.

TABLE SHOWING NUMBERS TREATED DAILY.

Date	Admitted	Out-patients	Discharged	Died
January 1 ..	—	54*	—	—
,, 2 ..	89	137	—	2
,, 3 ..	85	154	7	3
,, 4 ..	21	98	37	2
,, 5 ..	9	51	5	3
,, 6 ..	17	57	7	2
,, 7 ..	13	61	4	3
,, 8 ..	4	61	9	2
,, 9 ..	3	36	12	4
,, 10 ..	2	43	2	3
,, 11 ..	1	44	4	2
,, 12 ..	3	51	98†	3
,, 13 ..	10	48	2	1
,, 14 ..	1	68	13	3
,, 15 ..	2	62	6	2
Transfers to Italian Red Cross			19	—
	260	1,025	225	35

* Treated by party landed in the afternoon.

† 86 transfers to hospital train of Order of St. John.

NOTE.—About 150 destitute, with slight injuries, received food and casual treatment which is not recorded above.

Physical pain was not the only form of suffering in the wards. A patient awake at night was asked, "Senti molto dolore?" "No, poco." "Perchè dormire non posso?" This resulted in anguished weeping for parents, brothers and sisters, all dead; fortunately sympathy can express itself without speech. Each day marked a steady lessening of despairing fears, and, from January 5, most were capable of enjoying any humour that surroundings would provide. "Come si chiamo?" The reply, "Mazza Maria," caused signs of merriment in every face, except the two speakers. The

lady had her head bandaged, and was really suffering from contused wounds all over the body. Her surname was appropriate.

"Sorella, sorella mia!" the plaintive oft-repeated cry of female patients, made us again feel thankful that our own nursing sisters were with us, though their presence was as helpful among the out-patients as in the wards.

On the evening of January 3 the Staff was unexpectedly increased by two doctors (one a lady), three nurses and a secretary, sent by the Roman Relief Committee to Messina. They had arrived there on the 1st, were sent across to the British Naval Hospital at Villa San Giovanni on the 2nd, and their arrival at Catona seemed opportune, as there had been 174 admissions and about 300 out-patients during the first thirty-two hours. Work in the wards remained heavy, but the number of fresh cases next day and afterwards was at no time excessive.

The general improvement in spirits synchronised with the first issue of fresh bread, a boon to all concerned, for much trouble had been taken to prepare ration biscuit in various ways, but without success, as they were not appreciated.

Curiously enough, in a district where thirty delicious oranges could be had for a penny, marmalade was detested, and when spread on bread was either picked off or subsequently ejected from the mouth.

On January 7 a quantity of fresh meat and vegetables was provided by the Italian authorities, and supplied thereafter daily, but there was greater joy next day when the Italian cruiser "Re Umberto" landed a supply of macaroni, a want long felt in the wards.

A severe "scossa" occurred about 7.15 p.m. on the evening of the 7th, and several patients endeavoured to drag themselves outside the curtains. Some of the cracked walls in the town collapsed with a crash, and the dagshais on our cookhouse fire chattered. The maximum duration cannot have exceeded eight seconds, but it was the severest we experienced during our stay, although there were two or three distinct tremors almost daily.

The hospital was inspected on the 5th by the British Admiral Commanding in Chief; on the 6th by the General Officer Commanding Reggio District; on the 7th by H.R.H. the Duke of Genoa, and on the 11th by H.R.H. the Duke of Connaught, who sent a most generous supply of comforts for the hospital staff. These gifts of His Royal Highness were very much appreciated.

On the 12th a large consignment of very useful clothing arrived

from the Malta Relief Fund, and was handed over to the Commandant for distribution to the neighbouring villages.

The catastrophe had for the time abolished class distinctions; rich and poor, peasants and gentlefolk, lay side by side. In most of the wards there were one or two who assisted in making intelligible the words of others who only spoke the dialect of the hill country. It soon became apparent that more than one half of the number would require prolonged treatment in a permanent hospital, and when the railway line was re-opened the Military Commandant at Catona applied for an ambulance train, which came in the early afternoon of January 12th, organised and administered by the Order of St. John of Jerusalem, with headquarters at Milan. The Commandant supplied soldiers as bearers between camp and train, and the entraining was done most methodically and gently, the carriages being grouped in pairs, separated so that each carriage had an open space at one end for receiving stretchers. The squads left camp in batches of five, and the transfer was completed in a little over two hours.

Many patients or their relatives, or both, had a suspicious dread of being taken away, and in several cases bedridden patients were taken back to the family orange groves, where rough shelters were being made close to the ruins of their home, rather than submit to transfer to Naples or further north. A few were actually taken off the train after transfer. Some were brought back next day for re-admission by relatives sincerely regretting their impulsive action. A good wooden hut built by the Zappatori of the Catona detachment had been opened on January 6th, for female patients marked "convalescent," and for the surviving and homeless "Figlie dell' Immacolata" from the wrecked Orphanage in Salice. On the morning of January 14th these Sisters of Mercy moved into a hut specially prepared for them in the town. The Sappers rapidly laid a tufa brick floor in the convalescent hut, which was now large enough to accommodate all the female patients, so as to facilitate their transfer, as arrangements had been made for an Italian Red Cross party to come and take over our duties.

This party arrived, well equipped, from Perugia at dusk on the 15th, and very shortly afterwards H.M.S. "Lancaster" came to embark us at once for Malta.

Three search-lights were turned on the camp, and about 180 men landed as working parties. Five hours later the "Lancaster" weighed for Malta, and we felt regret at leaving good friends so suddenly. The Commandant had throughout given us every

possible assistance, and good comradeship had rapidly developed amongst all ranks. The British officers and nursing sisters had accepted an invitation to dine with the officers on the following evening, and had reluctantly to forego the pleasure.

On January 16th we arrived at Malta about 11.30 a.m.; H.R.H. Field-Marshal Commanding in Chief came on board ship. All the officers and nursing sisters had the honour of being presented and His Royal Highness was graciously pleased to express his satisfaction with the work that had been done. Disembarkation began after the men had dinner, and was completed shortly after 5.30 p.m.

In conclusion, I wish to thank Major Crawford, Captain Winckworth, and brother officers for much valuable assistance in preparing this report.

A SIMPLE METHOD OF EXTRACTING GASES DISSOLVED IN WATER, SEWAGE EFFLUENTS, &c.

Major W. W. O. BEVERIDGE, D.S.O.
Royal Army Medical Corps.

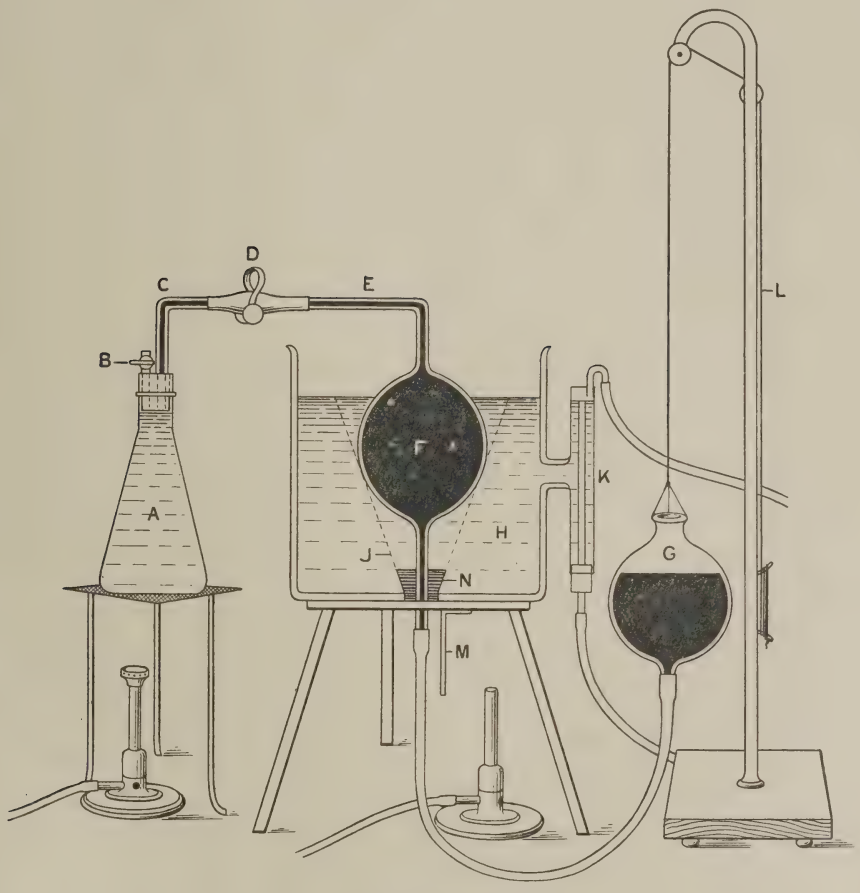
The following is a description of a simple process which we have found to be accurate and efficient for extracting the gases dissolved in water and sewage effluents. It is especially useful in estimating the amount of oxygen, carbon dioxide, methane, &c., present in sewage effluents, a determination of considerable importance.

An Erlenmeyer flask (A), holding from 150 to 300 cc., according to the amount of gases dissolved, is fitted with an india-rubber cork having two holes, through one of which passes the tube of a small stopcock (B), and through the other a capillary tube (C) having a bore of about 5 mm. and bent at right angles. The ends of both tubes must be flush with the bottom of the cork. The flask with the cork and tubes inserted is carefully weighed. The fluid to be examined is then cautiously syphoned into the flask, which must be filled to the brim, taking care that the lower end of the syphon reaches to the bottom of the flask, so that no admixture of air takes place, which otherwise would necessarily vitiate the results. The cork with the stopcock open is carefully inserted so that no bubbles of air are allowed to enter and is then pressed home; this causes the fluid to completely fill both the tube of the stopcock and the capillary tube C. The stopcock is then closed and also the end of the capillary tube by means of a piece of india-rubber tubing and an ordinary clamp, so that on relaxing the pressure on the cork no air can enter flask A, and the tubes remain filled with the fluid.

The stopcock is inserted as a precautionary measure to blow off steam from the flask, when the gases have all passed over into the bulb F and the connection at D is closed. Its tube should be as short as possible and of capillary bore, and as some gas collects in the bore, this amount previously ascertained should be added to the total amount extracted; but where very accurate results are not required it may be disregarded, as the quantity is very trifling.

The flask is again weighed, at the same temperature as when empty, to obtain the exact amount of the fluid taken. The

bulb F, capable of holding 150 c.c., has a capillary tube (E) leading from the upper part, bent at right angles, and a tube of wider bore at the lower part. The whole rests in a perforated funnel (J) and is surrounded by water contained in a copper water-bath (H) fitted with a continuous flow regulator (K), as shown in the figure.



Gas Extraction Apparatus.

The lower tube of the bulb F passes through a rubber cork (N) at the apex of the funnel J and is connected to a mercury reservoir (G) by means of a length of pressure tubing. The mercury reservoir can be raised and lowered at will by means of a wire passing over pulleys on the supporting stand L. A shield of metal (M) is fixed

at right angles to the bottom of the bath, to protect the lower tube of the bulb from the flame of a bunsen burner. The bulb F and the capillary tube E are completely filled with mercury by raising the reservoir G. Connection is then made with the capillary tube from the flask A by squeezing the air out of the india-rubber tubing with the fingers and rapidly connecting with the tube E of the bulb, now filled with mercury; in this way no air can enter. The clamp at D is now opened and the mercury reservoir lowered so that the fluid in the flask can be boiled under reduced pressure. Heat is best applied to the flask A by means of a rose-burner and the contents allowed to boil gently for about thirty minutes, when all the gases dissolved will have passed over into the bulb F. A certain amount of steam also passes over and is condensed in the bulb F by means of a continuous flow of cold water. This condensed water will be saturated with the gases, so that we have then in the bulb gas plus gas dissolved in a certain quantity of water. When all the gas has passed over the clamp at D is closed, the stopcock B opened and the flask disconnected.

It now remains to collect the total amount of gas from the bulb F for measuring prior to analysis. A nitrometer, or, better still, a Japp's gasvolumeter is filled with mercury and connected by means of the rubber tube at D with the bulb F, taking the same precautions to avoid any entrance of air. Where a quantity of gas amounting to 100 cc. or over is obtained, it is more convenient to pass it directly into an Orsat's gas analysis apparatus. The reservoir G is now lowered and the water in the water-bath heated by means of the Bunsen burner placed beneath. Owing to the reduced pressure, the gas dissolved in the water in the bulb readily passes off and the whole amount of gas can then be passed into the nitrometer by opening the clamp at D, raising the mercury reservoir G, and lowering that of the nitrometer or other apparatus used. The volume of gas collected is now measured, after the usual necessary correction for temperature and pressure, and calculated for the amount of fluid taken. It is then ready for the separate analysis of its constituents.

I have obtained by this method results concordant with those of the Letts and Blake process for the estimation of dissolved oxygen in sewage effluents. The whole process of extraction occupies usually about an hour and permits of a complete analysis of all gases dissolved in sewage effluents or other liquids.

LACTIC ACID BACILLI: RELATIVE ADVANTAGES OF LIQUID AND SOLID PREPARATIONS.

By Dr. F. G. BUSHNELL,
Pathologist to the Sussex County Hospital,
And Major G. DANSEY BROWNING,
Royal Army Medical Corps.

(Second Communication.)

In a previous communication we showed that commercial liquid preparations of lactic acid bacilli contained pure cultures of the Bulgarian bacillus, and that the solid preparations examined by us were found to be invariably contaminated by spore-bearing and other organisms. Unfortunately, the length of time during which liquid commercial preparations remain active is of relatively short duration, so that only young cultures can be employed. Even at room temperature the amount of acid produced by the Bulgarian bacillus in pure cultures is so considerable that after a period varying from ten to twenty days the preparation becomes inactive. The bacilli grown in such preparations cease to stain by Gram, and later on fail to multiply in subcultures. These phenomena are observed when the acidity of the medium containing the Bulgarian bacillus exceeds 2 per cent. The solid preparations, on the other hand, produce only a small amount of acid when grown at room temperature, and the amount produced is insufficient to inhibit the growth of putrefactive micro-organisms. This is also observed when solid cultures are grown at 37° C. The administration of solid preparations is therefore practically useless, as is also the administration of liquid preparations in which the Bulgarian bacilli have been killed off by excessive acidity. As young cultures are not always available, the excessive acidity of an old culture may be neutralised by means of an alkali. If lumps of solid calcium carbonate be added to a young culture at the time of its preparation, no excessive development of acid is observed. The excess of acid formed is neutralised at the time of its development, and a vigorous bacterial growth is consequently maintained.

The particles of calcium carbonate can be separated by filtration from the liquid medium prior to its administration to a patient. If it be preferred, the preparation containing calcium carbonate may be kept as a stock culture at room temperature, and young cultures can be inseminated from it for administration when required.

The quantity of calcium carbonate necessary for the neutralisation of the excess of lactic and other acids formed will vary with the prevailing temperature, and with the length of time which will elapse between the date of preparation of the culture and that of its administration.

United Services Medical Society.

WHAT CAN BE DONE BY MEDICAL OFFICERS OF THE TERRITORIAL FORCE IN TIME OF PEACE TO PREVENT DISEASE AND FURTHER EFFICIENCY IN TIME OF WAR.

By Lieutenant-Colonel C. H. MELVILLE.
Royal Army Medical Corps.

The subject on which I have the honour to address you this evening may be divided into three heads: First, sanitary education; secondly, the collection of sanitary intelligence; and lastly, the encouragement of physical education.

The first point, then, which I would like to emphasise is the necessity of educating the men composing the Territorial army in the essentials of camp sanitation. When war breaks out, and more especially if that war takes the shape of an invasion of these islands, I need hardly say that it will come without much warning, like a thief in the night. Each member of the Territorial army will find himself suddenly transformed from a civilian into a soldier, and not only that, but a soldier in the field; for whether the first notice we get of war is the landing of a body of the enemy's troops on our shores, or the more regular, but at the same time, I may remind you, the historically less frequent, presentation of a diplomatic ultimatum, the man in the ranks of the Territorial army will find himself sleeping under his domestic roof one night, and under canvas the next, or if not under canvas in some extemporised barrack. It is not to be supposed that accommodation will be available in barracks, properly so called, since the location of troops will not be governed by the position of existing barracks but by strategical reasons, which will necessitate the formation of large camps or the housing of large bodies of troops in billets, or in barracks extemporised from large warehouses or factories, shut down in consequence of the stoppage of trade, and so on. Billeting is extremely unlikely to be resorted to in consequence of the difficulty of maintaining discipline amongst partially trained troops under such conditions. Extemporised barracks may be used in some cases, but even this is improbable, since accommodation of that kind is likely to be more useful for hospitals, stores, and so on. Therefore we must recognise that the day after mobilisation is ordered the great majority of

the men of the Territorial army will find themselves either under canvas in standing camps, or *en route* to them; or, if the weather be fine and the season of the year favourable, in bivouacs.

Now I wish to point out to you what this means. It means that a matter of 250,000 men in this country will pass suddenly at twenty-four hours notice from the existence of civilised men to that of savages, speaking in a purely sanitary sense. Up till that moment they will have lived the life of civilised men. The two great functions of sanitation—water supply and the removal of excreta—have up to that moment been performed for them. The turning of a tap, or the pulling of a handle, comprise all the individual effort demanded of the civilised man in these two directions. If either the tap or the handle should fail to perform their proper duties, the plumber or the turncock is at hand to rectify matters. In any case, that rectification is not in the hands of the individual man concerned. All sanitary work is performed for him by the plumber or the turncock, and unless actually in his own house, under the direction of some municipal, or urban, or other authority. But now he suddenly finds himself in a position where none of these exist. He is now individually responsible that his excreta, which can no longer be removed automatically from the neighbourhood of his dwelling, do not become a source of nuisance or danger to himself or his comrades, and he is individually, though to a somewhat less extent, directly responsible that the water he drinks is pure.

Now I wish to emphasise most strongly that the responsibility of the soldier with regard to his excreta and their proper disposal is absolutely and directly personal. It is his personal and individual business to see that they, and the potential infection they contain, do not get the slightest opportunity of contaminating his own air, water or food supplies, or what is far more important, those of his comrades. If he were the only person likely to be injured, the only person likely to die of enteric fever as the result of his carelessness, we might pass it by, and with Dogberry, "Thank God we have got rid of a knave." Unfortunately, we cannot so limit the consequences of his carelessness. The soldier who carelessly exposes himself in action risks his own life and that of no one else. The soldier who exposes himself to disease, by carelessness in the matter of disposal of his excreta, lays open to the risk of infection not only himself but every one of his comrades. His position is not so much that of the careless soldier as that of the traitor who fires into his own ranks. This

may seem rather an exalted view to take of the situation, but I think if you will try and realise what the result of carelessness in the disposal of excreta means, especially if widespread in an army, you will agree with me that it is by no means too exalted a view. This is the rock on which the sanitation of all hurriedly assembled, partially trained, armies has split. It is only necessary to read the reports of Reed, Vaughan, and Shakespeare on the outbreaks of enteric fever in the army of the United States in 1897 to realise this. *This rock can only be avoided by instruction in time of peace, and this instruction as regards the soldiers of the Territorial army can only be given, in time of peace, by the sanitary and medical officers of the Territorial army.* This, then, is the first step in the sanitary education of the soldier. Instruction of the men and officers of the Territorial army that every man is to cover his excreta with earth directly they have been passed; and that this must be done not in an hour, nor in half an hour, nor in ten minutes, but at once. If excreta be covered the immediate danger of infection getting into the air, water, or food supplies of the force is avoided. As long as they are uncovered they are at the mercy of flies, and to a less extent in this climate, of wind. If they are covered, and covered at once, this danger at least is averted. I do not propose here to enter into the vexed question of the vitality of the bacillus of enteric fever in soil. This is probably greater than was at one time supposed. Still there is one thing certain, and that is, that as long as the germ remains buried in the soil the danger from it is more potential than actual. As long as it remains exposed to flies and wind the danger is actual and not merely potential. This knowledge must be hammered into the heads of the men in season and out of season in time of peace, and into the heads of their officers, too. The immediate burial of excreta is the first and leading principle of all camp sanitation. If this is not done no other sanitary measures will be more than a tinkering with the evil—a vain attempt to make up for a hopelessly lost opportunity. That is the first thing that the men and officers of the Territorial army should be taught; and the second is that all garbage, kitchen refuse, horse litter, and so on, should be burnt on the day of its formation. Except in extraordinarily bad weather this is possible, and in very bad weather flies are less *en évidence*. For of course it is against the fly that this measure, too, is directed.

The great principle here, as in the burial of excreta, is that what is to be done must be done quickly. If garbage be allowed to accumulate then it is difficult to destroy it by fire; and the

corollary is not only that it must be destroyed by fire at once, but also fairly close to the spot where it is formed. There will probably be no carriage available for the transport of rubbish to central incinerators, and therefore it must be burnt in the vicinity of the unit responsible for its formation. It is quite possible that a certain amount of annoyance may be caused by the smoke, and to a certain extent by the smell of the burning, but at the worst that will be an annoyance, an inconvenience, not a danger, and if it is a question of annoyance, the annoyance that a plague of flies causes in an ill-kept camp is a thing absolutely unique and by itself, far worse than drifting smoke or the smell of burnt garbage. The third thing that the men must be taught is moderation in drinking, I do not mean alcoholic drinks, but drinking generally. I do not believe myself that it is possible to train men to such a pitch that they shall never drink, however thirsty, simply because the water is labelled dangerous. That may be possible in some nations ; I have never seen it. I can only say that, taking the average human man of our race there comes a point when drink he must, be the water good or bad. There comes a stage of thirst when even if water were labelled poison the ordinary man would willingly drink it and risk the consequences, if only to escape the intolerable torture of thirst, and have the sensation of liquid in his throat before he dies. But it is quite possible to teach men to be moderate; to teach them not to rush at water, good or bad, and drink it simply because it is there. The ordinary man suffers not from the thirst of necessity—the torturing thirst to which I have already alluded—but from the thirst of habit, and this thirst of habit he can be educated out of, and he must be educated out of it if he is to be an efficient soldier. And one of the most important points about educating him out of this thirst of habit, and one of the strongest arguments in favour of doing so, is that when he has learnt his lesson you will then know that if he complains of thirst it is the real thirst, the thirst of necessity, that he is suffering from. The corollary of course of this is, that if you teach your men to restrain the thirst of habit, you must guarantee them such a supply of pure water that they may be able to gratify the thirst of necessity, that is to replace in the blood the actual amount of water lost by perspiration and necessary for the proper working of the human engine.

Though I have been referring here to water only I should like to say a few words about temperance in this connection. Personally, I am not an advocate for total abstinence under

ordinary conditions. I would prefer to see in the ranks the men who knew when to stop, rather than the men who dare not begin. But whatever a man may be in peace, in time of war, and especially in a friendly country, the only hope of salvation is in total abstinence. There will be plenty of people only too ready to display their patriotic fervour by standing drinks to (and incidentally sharing drinks with) their gallant defenders. Fortunately, the Regular army is not in the habit of fighting except in the countries of our enemies, or else in uncivilised lands where alcohol is unobtainable, so the question of temperance on service concerns the regular soldier comparatively little. But it will concern the Territorial soldier and his officer very seriously, and unless they are prepared for it I should be sorry for the commanding officer who tried to get his regiment through a market town on its way to the front, and especially if he hoped to get it through intact and sober. You probably know Hogarth's sketch called "The March to Finchley," commemorating the march of troops from London to Finchley Common in 1745, and the drunken stragglers left behind. It will not be the fault of the men in the ranks, it will be the fault of the enthusiastic spectator, who will not understand that a drunken soldier is no soldier when it comes to fighting and marching. This is hardly even a medical question, it is more one of discipline, but having mentioned the subject of temperance in drinking water, I felt I ought not to let this other phase of drinking go unmentioned.

Before leaving this part of my subject I should like to refer to one point which, in my opinion, is closely connected with the prevention of disease in war, and that is preventive inoculation against enteric fever. That every young man who is going to be exposed to the risks of campaigning should be inoculated is my firm belief. As a practical measure, extended to all ranks of the Territorial army in time of peace (it would be impossible to perform the inoculation after the war had broken out), there are great practical difficulties in the way. There are, as you know, plenty of people obsessed by the idea of the essential sin of self-defence against human enemies, and if to these we add their intellectual first cousins, equally obsessed with the idea of the essential sin of self-defence against disease, we shall not smooth to any great extent the path of those who are working for a strong and efficient National army. Still, of the benefits of inoculation there can be no doubt to anyone who studies the evidence, and if the prejudice against it is ever to be removed, the medical officers

of the Territorial army are in a better position to effect it than any other body of men in the country.

These points of education, therefore, are the first methods by which the medical and sanitary officers of the Territorial army can during peace further efficiency in time of war; for remember that this education must take place in time of peace or not at all. Once the Territorial army is mobilised there will be no time for education in anything but fighting. No commanding officer can then afford a minute of the short time remaining to him in which to train his unit (and that time will not be one minute too long, or one minute longer than the enemy can manage to make it). He cannot afford one minute of that short time for any other purpose than battle training, not even for a purpose so important as training in sanitation. So that if your men go into the field untrained in that, more especially in the simple routine of personal conservancy, untrained they will remain. And the logical and inevitable consequence of that want of training will be, I think I am moderate in saying, 5,000 cases of enteric fever in the Territorial army by the end of the first month of mobilisation, and I should be inclined to say, 5,000 deaths from the same disease in the first six months; and the responsibility for that loss will rest in the first place on those officers—medical and sanitary—of the Territorial army who have not taught their men, before war broke out, how they must conduct their personal sanitation after they go into the field.

How this instruction is to be imparted will be more or less a matter for local arrangement. It will be necessary to lecture the men to explain the rough principles, but of course the best training in field sanitation, as, indeed, the best training in all the operations of war, is actual practice on manœuvres or in camp.

I now come to the collection of sanitary intelligence; and this is a matter in which not only the medical officers of the Territorial army can help us, but in which all the country practitioners of the British Isles can take a share. There have been, except on manœuvres, no great movements of troops in these Islands since the invasion by Prince Charles Edward in 1745, one might almost say the Battle of Worcester. In a military sense the country, speaking from the point of view of the military sanitarian that is, is a *terra incognita*. Now, there is no body of men better placed to collect the information necessary to dispel this ignorance than the medical practitioners of the country districts, and the information

we need is as follows: Firstly, as regards camp grounds. We want to know in what parts of each county are good open spaces where troops can camp. A list should be made of these for each county, giving the following details: To begin with, position. This should be given first, by distance from two well-known towns on a main road. Then should follow more accurate local details of position, which will, I regret to say, be best given by reference to some licensed house of refreshment in the vicinity. Then the area, roughly, in acres; condition of the surface, as grass, heather, gorse, and so on, whether lately or ever under cultivation. Configuration of site, whether level or gentle slope, and in that case aspect, whether liable to floods; whether sheltered by woods or exposed; nature of soil, and geological formation. Lastly, water supply, its nature, whether from a well, stream, or large pond, the possibilities of pollution and probable quantity of supply available in ordinary weather. After camp grounds we should require information as to roads. Of course, this already exists to a large extent in the excellent road-books of the Cyclists' Touring Club, but the information needs amplifying by the addition of sanitary information, and more especially as regards water supply along each road. Every stream crossing the road should be mentioned, with the nature of the water, whether markedly polluted or not above the crossing, average dry weather flow, and so on. The position of any large reservoirs or good wells in the vicinity of the road should also be noted. With such information it would be possible for an officer marching a body of troops from, say, Newbury to Oxford, to make up his mind where he could safely halt for his men to have their mid-day rest and replenish his water-carts.

The third item of information would refer to water supply only. Each river or brook should be taken from its origin and traced mile by mile downwards, the existence of any marked source of pollution, and its exact position and distance being noted. A strange officer going into a county to make a survey of this nature would be greatly handicapped by ignorance of local conditions, while any general practitioner in the locality could probably give the information off-hand by simply following the course of the stream on the map. The information already mentioned refers, of course, to conditions of camp and the march, but information about towns would also be of use, especially in respect of towns as regards site, not of the first degree of importance. What we should want to know would be the conservancy systems and water supplies of these towns, and how far these might be capable of

expansion or of standing any sudden strain. Large towns, such as the great manufacturing towns, could probably admit of a considerable influx of troops without difficulty, but smaller country towns, such, for instance, as Dorking, Guildford, or Ipswich, would probably find some difficulty in arranging for the sudden influx of ten or fifteen thousand men, an occurrence not impossible in the case of any one of these towns, having regard to their strategical positions. In the towns themselves we should need to know the existence and position of large warehouses or factories which could be made into improvised barracks and hospitals, and the possibilities of putting up the necessary sanitary fittings and connections with the assistance of local plumbers.

Other points on which information might be of great value there are, but I will not dilate on them now. Those I have mentioned are the most important, and a systematised knowledge of these might save endless trouble in the last rush of mobilisation and war.

There is one last point that I should like to touch on, and that is, perhaps, a little away from the trend of my paper. I refer to National Physical Education. There is no doubt that the ordinary man of the class from which we recruit the ranks of the Regular army, and to a less extent, though still to a certain extent, the classes from which the rank and file of the Territorial army will be drawn, do suffer from a want of ability to get the best use out of their limbs. I was told by the Inspector of Gymnasia the other day that the ordinary country lad when enlisted could not perform to order such a very simple evolution as is conveyed in the words, "Take three steps forward starting on the left foot, and then hop twice on the left foot." The wrong foot would inevitably be chosen to start from, three very uncertain, awkward steps taken, and the hops at the end would not come off at all. The man would possess an equal inability to walk straight along a chalk line drawn along the floor. After a few steps he would be crouching down to keep his balance. The fact seems to be that the recruit as he enters the Army possesses a vocabulary of movements even more limited than his vocabulary of words. Consequently, an appreciable portion of his short term of Colour Service has to be devoted to learning how to use his limbs, to co-ordinate these to his intellectual apparatus, so that a definite order received from an instructor shall be translated into a definite and well-balanced movement. Now there is, in my opinion, a very definite obligation on the part of medical and sanitary officers of the Territorial army, and not only on their part, but on that of the general practitioners of the country,

to encourage the introduction of general physical education throughout the country. There is in existence a National League for Physical Education and Improvement, which is working at present under the *ægis* of the Education Department towards the introduction of some such compulsory system. As a member of one of the working sub-committees of the League, I should like to take this opportunity of bringing its work to your notice. The more the children of the nation are educated to use their limbs, the better fitted the boys will be to become soldiers when they grow up, and the less time will they have to waste after enlistment before they can learn to use their rifles.

DISCUSSION.

Lieutenant-Colonel C. P. Oliver thanked Colonel Melville for his suggestive paper, and remarked that probably all those who had listened to it were convinced of the paramount importance of personal sanitation. All Territorial medical officers should exercise their influence in bringing home to the *combatant* officers the immense value of the strictest attention of all ranks to this point. He remarked that he had lately had personal experience of the light and airy fashion in which combatant officers of the Territorial Force treated the subject, and of the general apathy that pervaded the commissioned ranks in matters of sanitation. Not only was this apathy evinced when the question of the disposal of excreta and offalage was insisted on, but also when the food supplies were inspected in the morning, more than one stating it was very nauseating to him to inspect raw meat! When, however, it was discovered that the medical officers were sincere in their opinion of the great necessity of attending to these points, and had the courage of their convictions by keeping a close watch on the food supplies and on the condition of the latrines morning after morning, then they found very willing and loyal helpers in the erstwhile negligent officer. He felt convinced that there was a splendid opportunity for the Territorial medical officer to educate and also to gain the sympathy of the combatant officers in this direction. It was surprising how with but fifteen days at one's disposal, the men of the medical units realised the importance of a clean camp, and how keen and faithful they soon became in carrying out orders to ensure this. With reference to the latter part of the paper, in which comment was made on the physical deterioration of the recruit, Lieutenant-Colonel Oliver remarked that he looked for a great improvement in the physique of the rising generation as a direct result of the medical inspection of children attending the public elementary schools. This was the class from which practically the whole of the recruits were drawn, and if the Act is carried out in the spirit in which its promoters intended nothing but good could result.

Lieutenant-Colonel J. Harper thanked Colonel Melville for his very useful paper, and for showing Territorial medical officers the lines on which they could be usefully engaged during peace in preparing for war. The lecturer had pointed out the fundamental hygienic importance of the individual attending to his own excreta. The practical difficulty was now to teach this lesson to the officers and men of the *combatant* branches, who constitute the vast majority of the whole force, and are lamentably careless—probably through ignorance—on this point. Must they be taught by individual effort only, or should not this be backed by regulations or Army orders on the subject? With regard to inoculation for enteric, the practice of which was urged by the lecturer, inasmuch as the protective effect is only temporary, at which period of his service did the lecturer propose that the Territorial soldier should be inoculated so as to be ready for a war, the date of which was uncertain? He regarded the paper as a most useful and timely one.

Colonel A. Clark said he had not intended to speak on this subject at all, as he knew very little as regards sanitation, and besides he had not given much attention to the subject. There was one point he should like to mention, and that was with regard to inoculation. He certainly misunderstood Colonel Melville as regards the period, as he was under the impression that it only lasted for a limited time, and he did not see how it could be well carried out till a few days ago. Then he might also mention the difficulty medical officers had in showing the combatant officers the necessity for sanitary care. Indeed, up to comparatively recently, he thought combatant officers did not really pay attention to the Medical Department of the Volunteer army as they should do; but they saw differently now, and he thought things were proceeding better from the sanitary point of view. Indeed, at the camp at Salisbury last year, he was struck by the interest they took in medical and sanitary matters, and extra facilities seemed to be given last year to what had been given before.

Major W. S. Harrison said: I was glad to hear Colonel Melville refer to the necessity of inoculation against enteric fever. I think one can safely say that the protection afforded by inoculation will last for at least two years, and, as a matter of fact, I have found traces of the results of inoculation in the blood of men who had been inoculated seven years previously, though whether the protective substances were then in sufficient quantity to prevent infection it was impossible to say. Recent statistics have shown that inoculated men get enteric fever six to eight times less frequently than those who have not been inoculated, and it is a matter for those in authority to decide whether they are prepared to go into the field with an unprotected army, and have six to eight times more enteric fever than they need have or would have if they insisted on inoculation before mobilisation. This would have to be done

during peace time, for it would be impossible to carry it out after the outbreak of war. As regards the education of the troops in sanitation, this is very necessary. In camp, fluid excreta are deposited everywhere; as soon as it is dark no one thinks of using the proper urinals. Everyone, officer and man, micturates immediately outside his own tent. I have even seen a general officer doing it. Now it is said that some 20 per cent. of typhoid convalescents have typhoid bacilli in their urine, and that of these about 3 per cent. remain infective for some years. I made a rough calculation on one occasion that, in India, there must be at least one man in each battalion who is excreting typhoid bacilli in his urine. These bacilli are poured on to the ground, they get on the men's boots, are carried into their tents and shaken up with their blankets; and they remain alive for a long time. Even in India, where the sun is much more powerful than in this country, you can recover typhoid bacilli from the earth three days after it has been infected with a growth of the organism in urine. It should be considered a most serious crime for anyone, officer or man, to micturate on the ground of a camp, except in the appointed places. There is another matter which Colonel Melville did not refer to, that is the necessity for protecting the Territorial army against small-pox. I take it that at present very few of the men have been re-vaccinated. I had the curiosity to look up some figures about small-pox to-day. In the American Civil War, the Northern army, which was very similar in constitution to our Territorial army, had 18,962 cases, and 7,058 deaths; the Confederate army of Northern Virginia in fourteen months had 2,513 cases, and 1,020 deaths from small-pox. In the Franco-Prussian War, the German army of 913,967 men lost only 278 men from this disease, whilst the French army, who were badly protected, lost no less than 23,400 men from small-pox. In the Siege of Paris the French losses from small-pox were 6·76 per cent., and it is reported that German wounded lying alongside French wounded escaped the disease, whilst the latter were heavily attacked. These figures make one think! I would say in conclusion that, in my opinion, no army which is not adequately protected against small-pox and against enteric fever is properly prepared for war.

Colonel Macpherson said: The only criticism I would venture to make on Colonel Melville's paper is that it is too short. I should like to have heard him say something more about other conditions likely to affect the Territorial Forces in time of war, and not so much from the pointed view of camp sanitation. We know, and are learning, a very great deal about camp sanitation, so that education in this subject is a simple matter now, and there ought to be no difficulty in training the Territorial Force in this subject. I do not think, however, that it is camp sanitation which is our chief difficulty in this country. In case of war, large standing camps would, I imagine, be avoided, and the method of accommodating the Territorial Force would probably be in buildings.

What I should like to have heard Colonel Melville tell us is something about the sanitation of billets, a subject not dealt with in this country at all, and what precautions to take and what matters to consider in billeting areas. I think it is an important question to take up. Then, as regards enteric fever in this country, Colonel Melville said that there would be 5,000 cases within a month. I do not think that would be the case. I do not wish to minimise the importance of enteric fever for one moment, but I do not think we should have 5,000 cases in the first month of a war in this country. The experience of all wars shows that enteric fever in military operations is obtained in two ways, either by men suffering from or incubating enteric coming from their homes on mobilisation into barracks or into camps, or by troops operating in districts where enteric fever is prevalent amongst the civil inhabitants, either as an epidemic, but more especially as an endemic disease. In this country we have very little enteric as an endemic disease; nor does the Army itself suffer much from enteric at home. In European war, such as the Franco-Prussian War, enteric fever was not very prevalent, and I believe we should probably have still less experience of it in a war in this country, in which the Territorial Force might be engaged. On the other hand, the remarks of Major Harrison as to vaccination are very important; I was going to make similar observations myself, but he has anticipated me.

Surgeon-General Gubbins said: There are three points in connection with Colonel Melville's interesting lecture I would like to touch on, viz., the inoculation of Territorials, the collection of information as regards camps, and lastly, the education of regimental officers and men in personal hygiene and sanitation.

Now as regards the antityphoid inoculation of Territorials; I look upon this as impracticable and it would be most unpopular. To expect thousands of men to submit to vaccination against a possible attack of enteric fever on the eve of invasion is chimerical, and it must be borne in mind that the fate of the country would be decided—one way or the other—in a few weeks. Even in India we have great impediments in pushing the system, notwithstanding the fact that the troops are under strict discipline, that many Commanding Officers and, I hope, all Medical Officers, are enthusiastic on the subject; moreover, the disease is daily staring all ranks in the face. If such are our difficulties in a country where everything is in favour of developing antityphoid inoculation, how much greater would they be when dealing with a force where the above conditions would be entirely absent? I may add that I am personally a firm believer in the system, but it should only be carried out in those countries where the disease is endemic.

Next, as to the collection of statistics and information as regards camps in the United Kingdom by civil practitioners. I much fear that these gentlemen have neither the leisure nor necessary knowledge or equipment to do so. I do not possess sufficient acquaintance with the inner working

of the Intelligence Branch at the War Office, but I am inclined to think that they are the proper people to deal with this item: of local authorities, I would imagine that the various Medical Officers of Health would be able to supply valuable information.

Coming to the last point, viz., the education of all ranks in personal hygiene and sanitation, I am entirely in accordance with the views of the lecturer. In this direction Council Schools can do a great deal in training the youths who will hereafter join the ranks of the Territorial Force. I need only mention one item, viz., the care of teeth. From my past experience of the condition of the boys' teeth in a large military school in London, and recently of 5,000 children of British soldiers on the Indian Establishment, where in both instances 90 per cent. of these young people required dental treatment, I am convinced that much can be done in their youth to remedy a state of things that is most unsatisfactory. I understand that the Education Committee of the London County Council is about to grapple with this question, and not before it is wanted. As a great surgeon in the past truly said, "A nation with bad teeth is a nation doomed to decay." In the Regular army we have made a great stride by the issue of tooth-brushes to every recruit on joining: it only remains for medical and regimental officers to see that good use is made of these articles. As to camp sanitation, there is no doubt that the Medical Officers of the Territorial Force are fully alive to its importance, and we must only hope that the staff and regimental officers will fall into line and follow the example of their brethren in the Regulars, who have made remarkable strides in this direction in the last few years, as I can personally testify.

Lieutenant-Colonel Cottell thanked Colonel Melville for his interesting paper, and said he considered his brother officers of the Territorial Forces might do good work by impressing on men when joining, the great importance of always wearing well-fitting broad-toed boots. Nearly all *civilians'* boots were too narrow and too short. He also said he was very glad Colonel Melville had raised the question of drinking, not only of alcoholic preparations but of all fluid. Drinking was a habit and could be and should be trained. If men began the day by drinking the contents of their water-bottle they would certainly suffer far more than the men who abstained from what was undoubtedly a vicious habit.

Major J. Ritchie considered that the education of the officers and men in the elements of sanitation was the most important duty of the Territorial medical officer. Unless the men acted with the sanitary officer all his efforts were baulked. The Territorial medical officers who had spoken seemed to despair of convincing combatant officers and men of the importance of sanitation. He had shared this attitude himself until recently, but his experience of camps convinced him that the sanitary lectures given during the last few years had borne fruit in great attention to sanitation both by officers and men in the Regular army. No doubt

were such lectures instituted in the Territorial Force, it would follow in the footsteps of the Regular army. He suggested that during route marches no water-bottles should be carried, and no men allowed to fall out to drink. They would soon learn how easy it was to do without drinking, and how much better they would march. Compulsory inoculation of recruits against enteric fever was at present an impossible ideal. All medical men might be said to agree as to its efficacy, but in a country where public opinion allowed a few dunderheads to keep their children unvaccinated, and thus be the focus for the spread of a loathsome disease, it was idle to expect that compulsory inoculation against enteric would be permitted either in a citizen or regular army, more especially as to be of any value the inoculation must be submitted to every two years.

Clinical and other Notes.

A CASE OF COMPOUND FRACTURE OF RADIUS AND ULNA—MALIGNANT ŒDEMA—AMPUTATION—RECOVERY.

By Captain T. MATTHEWS.
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Gunner C., aged 23, was admitted to the Royal Herbert Hospital on April 13th, 1908, suffering from a compound fracture of the right forearm and a scalp wound at the back of the head. He had been knocked down and run over by a field gun.

The whole of the forearm and lower half of the upper arm were much swollen; there was a small wound on the flexor surface of the forearm, at the junction of the middle and lower thirds; both bones were broken about the level of the wound. The humerus and elbow-joint were uninjured. There was also a scalp wound just below the crown of the head behind.

The wound on the forearm was cleaned and dressed with double cyanide gauze, and the limb was put up between two straight splints, nothing in the way of exploration being attempted owing to the man's lowered vitality. The radial artery could be felt pulsating. The scalp wound was next examined, and it was found that a flap 2 inches square, not involving the pericranium, had been stripped up. There was no sign of injury to the bone. The wound was washed out with perchloride lotion, a gauze drain introduced, and the flap kept in position by a pad and bandage.

On April 14th the patient, having recovered from the shock caused by his injury, was taken to the theatre. Having been anæsthetised with chloroform, an incision was made up and down the forearm from the existing wound and a quantity of blood-clot cleared out. The flexor muscles were found to be much lacerated, the muscular tissue was stripped off the tendons for a considerable extent, the resulting contraction producing a marked increase in the girth of the upper part of the forearm. All the tendons, however, were intact, with the exception of the palmaris longus. The ulnar and anterior interosseous arteries and veins were found to have been wounded, and ligatures were applied above and below the seat of injury. There was a transverse fracture of the radius and ulna at the junction of the middle and lower thirds, with some comminution of the latter bone.

The wound was thoroughly washed out with hot normal saline and the radius and ulna were wired with silver wire in good position. The portions of muscle stripped up from the tendons were removed. The wound was again well washed out with hot normal saline, the skin sutured

at the extremity of the incision, an india-rubber drainage tube and a gauze drain were inserted, the whole covered with double cyanide gauze, and the limb put up between two well-padded straight splints.

As the patient was somewhat collapsed after the operation a hot enema of normal saline, coffee and brandy was administered. The scalp wound was examined, and showing no inflammatory signs, was sutured.

Next day, on removing the splints and dressings, the whole of the forearm was found to be gangrenous with a most offensive odour, the skin from the roots of the fingers to the elbow being sap-green in colour. The fingers were normal, but the skin of the upper arm was a reddish-brown, the discoloration extending as high as the acromion process on the shoulder and for 2 inches below the axilla on the side of the chest; here the discoloration was bounded by a band of ischæmia about 2 inches in breadth. The upper arm was distended with gas to an enormous extent, crepitating freely on pressure being applied, and the skin was covered with large blebs.

Immediate amputation was decided upon as the only, though remote, chance of saving the patient's life, and I decided to go through the surgical neck of the humerus, on Major Holt's advice, as he did not think the patient would survive the shock of an operation through the shoulder-joint, though one felt anxious to go as high as possible owing to the state of the tissues that would have to be utilised as flaps.

Chloroform having been administered, anterior and posterior flaps consisting of skin and subcutaneous tissues were formed by an incision commencing over the line of the vessels at the level of the anterior fold of the axilla and carried to a corresponding point on the outer side of the arm. The vessels were ligatured and divided as high up as possible, the veins also being divided high up. The skin and subcutaneous tissues were next dissected up, the muscles divided circularly and retracted, and the bone was sawn through. The appearance of the stump was not encouraging, the tissues being terribly œdematous; so at Major Holt's suggestion, I washed out the wound with linimentum iodi. Two large gauze drains were introduced and the outer and inner margins of the flaps united by interrupted sutures, leaving the centre of the wound through which the gauze was brought out open for drainage. The stump was dressed with sterilised gauze soaked in 1 to 2,000 hydrarg. perchlor. lotion.

Ether, which was suggested by the depressed condition of the man's circulatory system, was contraindicated by the fact that he was suffering from bronchial catarrh contracted some days before his accident.

Before being removed to the ward he was given another enema of hot saline, coffee and brandy. The pulse at midnight was weak, rapid, and irregular. He was given liq. strychnine ♏iii. and adrenalin ad. ♏xx.

hypodermically; also liq. morph., gr. $\frac{1}{4}$. He was ordered to have $\frac{1}{2}$ ounce of brandy every two hours.

On April 16th the pulse was weak and the patient's general condition bad, his expression being anxious and distressed. The discoloration of the skin had extended in all directions, namely, to within 2 inches of the crest of the ilium below the axilla, to the right border of sternum on the chest, to the level of the cricoid cartilage on the side of the neck and to the most prominent part of the right erector spinæ muscles behind. The wound was dressed and the gauze plug removed, liberating some clear blood-stained serum. No further plug was introduced, the wound being simply dressed with sterilised gauze soaked in 1 in 2,000 hydrarg. perchlor. lotion. The whole of the discoloured area was mapped out with ink to determine the extent and rapidity of spreading. At midnight, inj. liq. morph. gr. $\frac{1}{4}$ was given as patient was very restless.

On April 17th the pulse was still weak and the patient's condition much the same, but he showed some slight sign of improvement. He coughed up some blood-stained sputum during the night. An examination of his chest revealed nothing beyond a few râles, and there was no consolidation. He was propped up a little, but owing to his feeble condition could not be raised much. The wound was dressed, the edges being separated to allow exit of fluid which consisted of clear red odourless serum. The discoloration of the skin had spread about 2 inches in all directions, reaching to the middle line behind and to the crest of ilium below. The whole of the discoloured area was painted with tinct. iodi. Half an ounce of brandy was still given every two hours.

On April 18th the patient was slightly better, but still coughed up blood-stained sputum. Owing to the improved condition of his pulse his shoulders could now be well raised. The bowels, which had required the administration of aperients hitherto, acted freely during the night, the motions being watery and blood-stained. The wound was dressed as before and there was a discharge of blood-stained serum. The whole of the discoloration, however, had disappeared, leaving only the staining due to the iodine, which presented quite a different appearance to the combination of iodine and the colour due to stasis in the capillaries of the skin. There was a strip of purple skin about 1 inch by $1\frac{1}{2}$ inches forming the margin of the outer flap near the axilla, which looked as if it were going to necrose.

On April 19th the wound was dressed and there was a purulent discharge from the interior of the stump. The sutures were removed from the inner half and then the wound was irrigated with 1 in 3,000 perchloride of mercury solution and an iodoform gauze plug was introduced. The bowels were still loose, motions being watery and blood-stained. Mist. catechu cum opio was prescribed. The outer half of the wound had healed by primary union, and the discharge came from the axillary half.

On April 20th the wound was dressed at 10.30 a.m. and again at 10 p.m., the inner half of stump being irrigated with a solution of tinct. iodi 33 per cent. The bowels were still rather loose: catechu and opium mixture was continued.

On April 21st the wound was dressed morning and evening; there was less discharge. The parts were irrigated with solution of tinct. iodi, and the sloughs were painted with tinct. iodi *undiluted*. The bowels were normal and catechu and opium mixture was discontinued.

On April 22nd the inner portion of the outer flap had recovered with the exception of the small strip half an inch wide, which was removed. The inner surface of axillary half of both flaps was covered with greyish-white sloughs as was also the axillary half of stump. The sloughs were painted daily with pure tinct. iodi and the wound was irrigated with 33 per cent. solution of tinct. iodi.

On April 23rd the inner surfaces of the flaps presented a more healthy appearance, bleeding from sundry points and showing signs of granulating: the apex of wound was still full of ragged sloughs. The patient's general condition was quite satisfactory; he no longer coughed up sputum; the bowels were normal, and appetite good. Except that the cuticle separated from the whole area that had been discoloured, the patient from this time made an uneventful recovery; the sloughs gradually separated, giving place to healthy granulation tissue and the wound finally healed, leaving a good stump. I am indebted to Captain Cowan, R.A.M.C., for the accompanying bacteriological notes on the case.

Bacteriological Report.

On April 15th, *smears* made from the œdematous tissue showed: (1) Bacilli with spores, Gram-negative, and (2) large bacilli, Gram-positive. Aërobic and anaërobic cultures in broth were then made: (*a*) From inner surface of an artery of the amputated limb—these proved to be sterile—and (*b*) from the œdematous tissue. The bacillus of malignant œdema and the *Bacillus aërogenes capsulatus* were isolated.

On April 19th, an anaërobic broth culture was made with serum from the operation wound and Gram-negative bacilli were isolated. An anaërobic subculture on agar was made on April 25th, and the bacillus of malignant œdema was isolated.

Report on Soil from Site of Accident.

The site was an ordinary broken-granite road in barracks with horse-dung and road "sweepings" at the side. A little coarse dust was taken from the road, mixed with sterile water, and strained with aseptic precautions. From this fluid anaërobic cultures in glucose broth were made (*a*) before and (*b*) after heating to 80° C. for five minutes. The bacillus of malignant œdema was isolated from both tubes, a pure culture being obtained from the tube heated to 80° C.

CASE OF COMPOUND FRACTURE AND DISLOCATION OF ELBOW-JOINT.

By Captain T. MATTHEWS.
Royal Army Medical Corps.

Boy S., aged 17, Royal Garrison Artillery, was admitted to the Royal Herbert Hospital, on September 5th, 1907, suffering from a severe injury to his elbow, caused by a fall in the gymnasium.

On removing the temporary dressings that had been applied, the whole of the articular surface of the lower end of the humerus was found

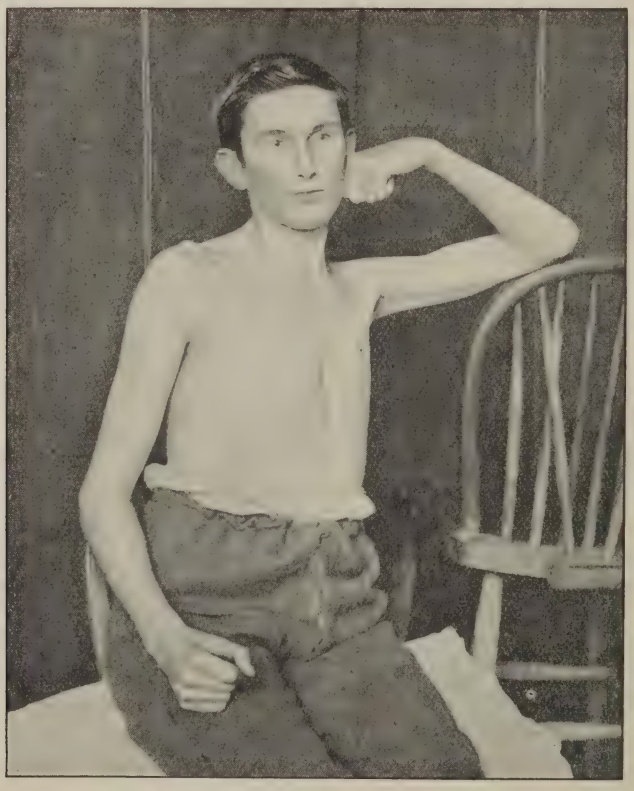

Fig. 1.

to be protruding through a longitudinal wound on the inner side of the joint, the brachial artery was laid bare, as was also the ulnar nerve, to which was attached the internal condyle which had been separated intact. The external condyle had also been detached and was splintered. The

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To illustrate "Case of Compound Fracture and Dislocation of Elbow Joint."
By Captain T. Matthews, R.A.M.C.

radius and ulna were dislocated forwards and pushed up on to the anterior surface of the humerus by the flexors of the forearm.

The wound was first thoroughly irrigated with a solution of hydrarg. perchlor. 1 in 3,000 and subsequently with hot normal saline, the dislocation was reduced, and the internal condyle was fixed in position with a small steel screw. Nothing could be done with the splintered external condyle. A sterilised gauze drain was introduced and the wound was stitched up with interrupted sutures, and covered with sterilised gauze. The limb was finally put up on an internal angular splint.

The wound was not touched for forty-eight hours, when the splint was taken off and the gauze plug removed. The wound looked far better than

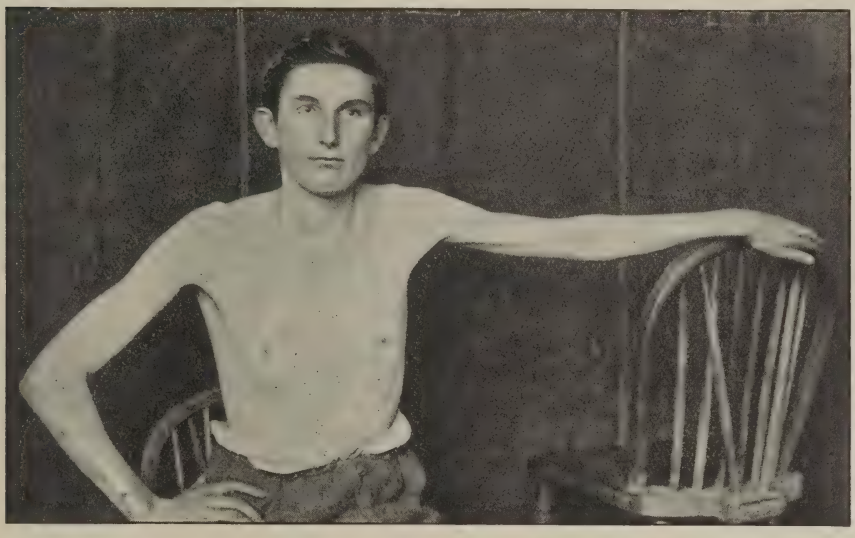


Fig. 2.

one could have hoped for. No further drain was introduced, sterilised dressings and the splint were reapplied, and as the patient had neither pain nor rise of temperature, the arm was left alone until the fourteenth day. On removing the splint and dressings at the end of a fortnight the wound was found to have healed by primary union. Gentle massage and passive movement were commenced forthwith and continued daily by myself; the amount of movement was gradually increased as time went on and special exercises against resistance were given for the flexors and extension of the forearm and upper arm.

The accompanying photographs of the patient show the range of movement on November 1st, 1907, the day before he was discharged to sick furlough, and the X-ray photograph, showing the screw *in situ*, was also taken on the same day.

He had excellent power and movement when he left the hospital, and all the muscles of the limb were in good condition. At the expiration of his furlough he returned to duty, which he has performed continuously ever since.

I confess that at the time I had grave doubts about the advisability of putting in a screw, seeing that the joint had been so exposed to sepsis, the first dressing, before he was seen by a medical officer, having been a pocket handkerchief, but in no other way could I fix the condyle in position.

ON THE ADVISABILITY OF THE OBSERVANCE OF STRICT ASEPTIC PRECAUTIONS IN DEALING WITH ABSCESSES.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

There is, or at anyrate used to be, a common idea that the observance of strict aseptic precautions in dealing with septic cases, or with collections of pus, is quite unnecessary. One has often heard it said, "Oh! the case is septic, a few more germs more or less will not make any difference!" Also one sometimes sees buboes opened without any previous attempt to render the skin of the part sterile, and dressings applied which are certainly not free from germs.

In the case of an abscess, the presence of the pus is an indication that the germs have temporarily obtained the upper hand, but as they have been subjected to the resistance which the natural fluids of the body provide, their vitality and virulence have been to a great extent diminished. This is well shown by the fact that it is possible to obtain healing practically by first intention in some abscesses which have been aseptically opened, wiped dry, and their walls brought into apposition by carefully applied pressure, or by deep sutures.

In a certain number of appendix abscesses, one has been surprised by the prompt healing of the wound, although it was, at the time of operation, apparently hopelessly fouled by stinking pus. Wounds, again, which have been soiled by pus in the removal of broken-down tuberculous glands, almost invariably heal by first intention, if one's aseptic precautions have been satisfactory.

When micro-organisms are admitted into a freshly made wound, suppuration usually results. When they are accidentally introduced into an already existing suppurating wound by means of unsterilised instruments or dressings, the partially devitalised organisms are reinforced by fresh and vigorous ones, and the consequence is that a wound which might otherwise have healed rapidly takes a much longer time to get well.

In abscesses which have a definite wall, it is common to find that the discharge after the first twenty-four hours is entirely serous. It is a

good plan in many cases to firmly pack the cavity for twenty-four hours with gauze, and to put in sutures which can be tied after the gauze has been removed, and a drainage tube inserted.

It is not advisable to try to forcibly remove the wall of an abscess by curettage, for it consists of a line of defending cells, and its removal often leads to a spread of the infectious process.

A CASE OF MECKEL'S DIVERTICULUM DISCOVERED DURING THE OPERATION OF APPENDECTOMY.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

The rarity of this condition must be my excuse for reporting it. Private S., aged 19, was admitted for chronic appendicitis. There was a history of four previous attacks extending over ten months.

The operation was performed under ether by Captain E. S. Worthington, through a small incision one finger's breadth inside the anterior superior spine. The appendix could not be felt or the cæcum seen. Coils of small intestine persisted in appearing at the incision. In pulling one of these forward a tube of intestine about 4 inches long came out. The tip was very cicatricial, and looked as though it had been adherent to some viscus at one time. The calibre, for about $2\frac{1}{2}$ inches, was fully as large as the intestine to which it was attached, and then it tapered gradually.

The appendix was subsequently felt floating free near the umbilicus, wrapped in omentum, and on drawing it out, a very diminutive cæcum appeared. It was funnel-shaped, and the appendix was a continuation of the funnel. The walls were extremely thick and fibrous, and the lumen throughout was very large. It contained several concretions, and some ulceration of the mucous membrane existed. After removal of the appendix, the diverticulum was clamped by Corner's clamp, tied with thread and cut away. The stump was then invaginated by means of a purse string suture.

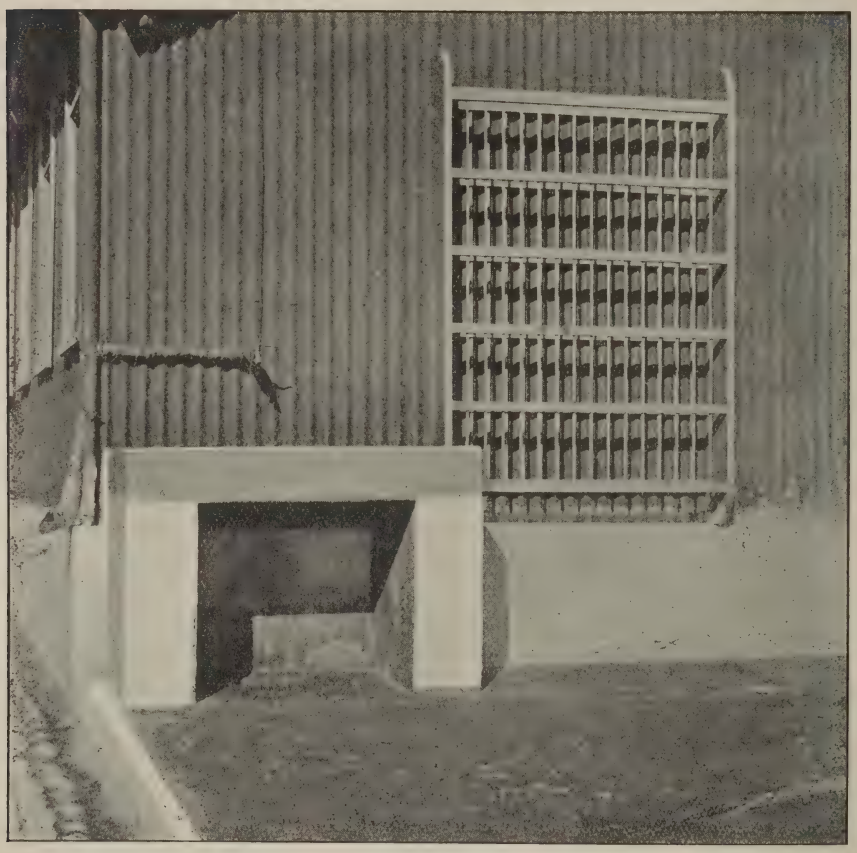
WASHING-UP ARRANGEMENTS IN BARRACK-ROOMS.

By Captain E. A. BOURKE.
Royal Army Medical Corps.

In his "Special Report on Enteric Fever and its Prophylaxis at Umballa, 1905," Lieutenant-Colonel T. P. Woodhouse alludes to better arrangements for the washing-up of food utensils, and in the Journal for May, 1908, Major W. D. Erskine describes in an interesting article the arrangement he has carried out. As regards South Africa, most authorities

are agreed that the origin of many epidemics of enteric fever is a contaminated water supply, with subsequent dissemination by flies, dust, &c. Careful attention is paid to the boiling and storage of all drinking water used in barracks, and yet enteric cases occur.

When going round barracks it has often struck me how very little attention is paid to the washing-up of dishes, &c.; boiled water obtained



from cook-house is supposed to be used, yet in actual practice water from the nearest tap is frequently employed instead. The meat dishes and plates are washed in buckets and generally placed on the ground previous to removal to the barrack-rooms, and when served out again for the next meal it frequently happens that the plates are more or less wet. When one considers that the water supply of this garrison (Bloem-

fontein) frequently shows on analysis *Bacillus coli*, it follows that some cases of enteric may be due to the defective arrangements provided for washing-up in regimental cook-houses.

I venture to bring forward the following arrangement which in practice has been found to work extremely well among the Hampshire Regiment at Naval Hill. The expense is very little, and I consider it might be adopted in many stations with benefit.

In this cantonment, as well as in others in South Africa, all drinking water is boiled previous to use, the method adopted being briefly as follows: Attached to each regimental cook-house is a large galvanised tank enclosed in brickwork, with fire-place beneath ; piped water is laid on, and two to three hours is sufficient to raise the temperature of the water to 95° C. (at this altitude 6,000 feet). After boiling the water is run off by pipe into a series of cisterns where it is allowed to cool before issue to barrack-rooms. As an ample supply of sterile water is available, I recommended the following arrangement, which the Divisional Officer, Royal Engineers, kindly carried out as an experiment :—

On a cement platform outside each cook-house a porcelain sink was erected and a piped supply of water from the steriliser laid on; on one side of the sink a large plate rack was erected, where plates are placed when washed, and allowed to drain before being brought back to barrack-rooms; consequently, drying cloths, with their liability to contamination, are unnecessary. The sink should, if possible, be 4 feet 6 inches in length, so that two men may wash up at the same time ; a small surface drain takes the waste water to a sump pit, so that the ground does not become contaminated. The photograph shows the advantage of this plan. One sink with plate rack is sufficient for each half-battalion cook-house, and one for the serjeants' mess.

We have had no cases of enteric fever at Naval Hill for the past eighteen months, though all other units in Bloemfontein living under similar conditions have furnished cases. When one considers how under ordinary circumstances the washing-up arrangements are carried out, the above suggestion will commend itself. Its advantages are as follows :—

(1) Only sterile water is used, as no cold water tap is laid on.

(2) A porcelain sink is provided for washing-up, instead of buckets or other receptacles, which are difficult to keep clean.

(3) Drying cloths, with their liability to contamination, are unnecessary.

(4) Breakages are reduced to a minimum.

(5) The washing arrangements are more easily carried out.

As an improvement to the plate rack shown in the photograph, larger compartments should be provided to hold mugs.

Surgeon-General W. Donovan, C.B., late Principal Medical Officer, South Africa, on the occasion of his annual inspection of Naval Hill,

April, 1908, reported as follows: "An improved system for washing-up plates, &c., has been adopted. It answers the purpose admirably, and its extension to other parts of the cantonments is advocated."

A METHOD OF MOVING HELPLESS PATIENTS.

By Lieutenant-Colonel R. KIRKPATRICK, C.M.G.
Royal Army Medical Corps.

I have often observed in the operating theatre a great want of method shown even by well-trained attendants when moving a helpless patient from a stretcher to the operating table and *vice versâ*. The removal of a patient in a condition of semi-narcosis *plus* shock after a severe operation from the operating table to the stretcher is frequently more like an obstacle race than an ordered medical procedure. At the moment of

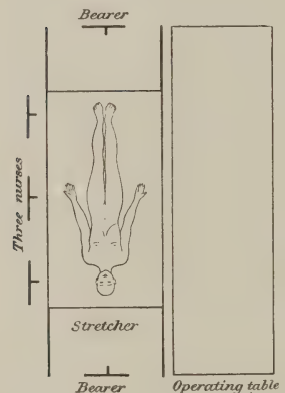


Fig. 1.

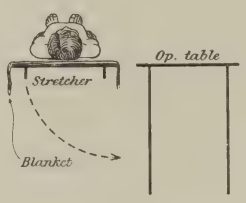


Fig. 2.

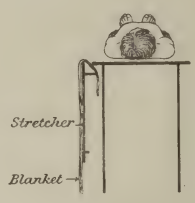


Fig. 3.

Fig. 1 represents bird's-eye view of position of table, stretcher, nurses and bearers.

Fig. 2.—Transverse diagram of patient on stretcher about to be lifted on to the table.

Fig. 3.—Transverse diagram of position (*a*) just after patient has been placed on table, or (*b*) just before patient is about to be removed from table.

removal the operating surgeon and his assistants may be chatting in a far corner, while two or three subordinates, without any arranged drill, are engaged in a violent struggle to remove the patient off the table on to the stretcher. If we follow the patient to the ward, possibly a second similar hurly-burly takes place in putting the patient into his bed.

I hoped to see some simple drill inserted in the new "Royal Army Medical Corps Manual," but as this has not appeared I make the following suggestion. It is a drill which I have long found very simple and good. Two bearers and three nurses are required (see figs. 1, 2, and 3).

(1) To place the patient on the operating table or bed the two bearers raise the stretcher to the level of the table (or bed) as in fig. 2. The three nurses then raise their patient off the stretcher. The bearers keeping that handle of the stretcher which is next the table steady, allow the opposite handle to fall like the flap of a folding table, so that the stretcher assumes the position as in fig. 3. The nurses then move forward and lower their patient on the table (or bed); after that the stretcher is removed.

(2) To lift the patient from the table (or bed) the process is reversed. The two bearers place the stretcher as in fig. 3. The nurses then lift the patient, and while moving back from the table (or bed) the bearers raise the stretcher to a horizonal position under the patient as in fig. 2.

Lecture.

"ON MATTERS RELATING TO THE CORPS."[1]

By Lieutenant-Colonel E. M. WILSON, C.B., C.M.G., D.S.O.
Royal Army Medical Corps (R.).

I have been asked by Lieutenant-Colonel Nichol to give you a short address on subjects connected with your duties as officers of the Corps. I know that since your arrival at the Depôt you have attended many lectures, and for fear that you may be inclined to say, as was said of a lady long ago, that you "had suffered many things of many lecturers, and were nothing bettered but rather grew worse," I will try to make my remarks as interesting as possible and reasonably brief.

As I have been connected with office work for some years, you must not be surprised if I devote a little time to what may seem uninviting topics, such as regulations, correspondence, forms, &c. I promise you at the outset that I am not going into unnecessary details, but only intend to give a few hints on matters which, whether you like it or not, you will have to learn sooner or later, and which it will be to your advantage to learn as soon as possible.

In "Little Dorrit" (I do not know whether anyone reads Dickens nowadays), the bright, engaging young Barnacle of the circumlocution office says to Arthur Clennam, "You had better take a lot of forms away with you. Give him a lot of forms." I am sure you would be as disgusted as he was if I spent this half-hour in discussing these printed abominations; but on the other hand, it is as well for your own sake,

[1] Delivered to officers under instruction at the Depôt, Aldershot, on October 24th, 1908.

if from no other motive, that you should realise the importance of having an accurate knowledge of routine administration.

Do not think this knowledge beneath the dignity of an officer of a scientific corps. Gibbon tells us that the gifted Julian, when studying whatever was the equivalent of squad drill in his days, ejaculated, "Oh Plato, what a task for a philosopher!" Do not you, when filling in some "beastly form," exclaim, "Oh Æsculapius, what a task for a bacteriologist!" and I will tell you why.

First, because it is essential, if you mean to be *top* in your own show, whether in charge of a hospital or as company officer at an outlying detachment, or as commander of a medical unit in time of war, that you must know a little more of everything than your subordinates, whether it is Military Law, King's Regulations, Standing Orders, or anything else. You should be in a position to teach them and not to be dependent on them for anything. A distinguished officer who once commanded this Depôt had occasion to reprimand a subordinate for slackness. "If you do not do your work better, you will go back to ordinary duty," he said, "I can do without you." "Yes sir," said the subordinate humbly, "I know you can, and that is the worst of it." Senior officers will, I am sure, agree with me on this point, especially as regards India, where there is a tendency, if not checked, for routine matters to get into the hands of native clerks, which is not desirable.

The second reason is, that undue reliance on juniors and subordinates must (apart from loss of personal prestige) sooner or later lead to disaster. You will at some time or another, to put it vulgarly, "get let in." An officer said to me the other day, with natural indignation, "My clerks expect *me* to know regulations and teach them, whereas it is their business." This is all very well, but if you act on this principle something will happen some day which "will hurl your soul from Heaven, and fiends will snatch at it," meaning, with all due respect, that Principal Medical Officers, Deputy Assistant Governors, Chief Accountants, and people of that sort, whose duty it is to correct officers when they go wrong, will have something to say that you will not like.

The third reason, which I have kept till the last, because I am certain it will appeal to you most, is that through ignorance or negligence you may do an injustice to a junior officer or subordinate of the Corps. I need not labour this point, because I feel sure that in such matters as confidential reports, favourable or otherwise, orderly-room awards, claims, recommendations, &c., you will wish to act perfectly fairly and with full knowledge of the results of your decisions, and this you cannot have without a thorough acquaintance with military law and the King's and other regulations.

One word about the much-abused "forms." If you were suddenly called upon to obtain or give certain information regarding a large body

of men, how would you proceed? You would at once make out and tabulate a "form," despatch it with instructions how to fill it in to the various individuals or departments concerned, and compile your own from the reports which you received. You could not do anything else, otherwise the clerical labour would be immense and the result unsatisfactory. I am not saying anything now as to whether the information is useful or necessary, only that you are ordered to do it, and I am suggesting the easiest way.

I well remember being on a committee at the War Office some years ago when this question was discussed. It was often said, "Why do you want a *form* for this?" I said, "Well, what do you propose instead? The information has to be given." The reply was almost invariably, "Make it out in manuscript." Now I pass round half a dozen of these detestable forms and ask any officer present which is the easier, to make out a score or a hundred or a thousand of these in manuscript with full directions, or to print an equal amount and give each a definite number.

Observe that each form has definite instructions and footnotes how to make it out, and observe also that I am not saying a word as to the necessity or utility of the forms when completed. It is sufficient for our present purpose that we are obeying orders. I only ask, which is the *easier*, which gives the least clerical labour to officers and clerks, and which is likely to be most uniform and accurate?

I think I may add after some years' work here and at the War Office, that no officer in the Army is anxious to multiply forms, but rather to simplify and reduce them, and so far as our own Corps is concerned I have done my best in that direction, and I shall always be glad to receive suggestions and recommendations for their further simplification in the future.

For your comfort I may say that company work has largely decreased in the last few years, and that as regards what remains you are no worse off than officers in any other branch of the Army.

Before leaving this subject may I give one word of warning regarding returns relating to accounts or money? These are to many, perhaps to most of us, the least interesting. A friend of mine at a foreign station once said that the only form of this nature which interested him was his own pay list, and that he generally did wrong! Yet none is more important. Should anything go wrong, little clouds have a tendency to grow into thunderstorms at very short notice. Not long ago some trouble occurred at a certain station regarding a postage account and the results were very widespread. I should like to urge junior officers never to sign a return connected with money until they are thoroughly satisfied as to its correctness.

Leaving paper work, which it is difficult to make attractive, I will turn your attention to something more interesting, and that is your

relations to the men you will command; and first and foremost I wish to lay stress, as I have done before in similar lectures, on the special advantages our officers possess over all other branches of the Army by the fact that they are the medical officers as well as the commanding officers of the Corps. From the commencement to the termination of his military service, when anything important happens to any soldier he is medically examined. As regards the commencement—his enlistment—I need not detain you, as I know this has already been brought to your notice by better men. I will only quote once more to you the instructions laid down in Recruiting and Medical Regulations. The first says:—

"Recruits for the Royal Army Medical Corps will not be finally approved until they have been certified by the medical officer as 'suitable for the Royal Army Medical Corps,'" and the Medical Regulations direct: "In passing recruits for the Royal Army Medical Corps the medical officer will satisfy himself that the recruit can read (not only printed matter but plain handwriting) and *understands* what he reads, and can write; he will not approve of any man who, judging by his want of education or intelligence, unsatisfactory character or appearance, does not seem likely to prove a suitable man for the Royal Army Medical Corps."

I ask you to bear these instructions in mind, and whenever you are engaged in recruiting, and a doubtful candidate for our Corps is brought before you, to think of two things: First, that our Corps is a favourite one and that it is always nearly full up and sometimes even in excess of its establishment, and that, therefore, there is no necessity to accept doubtful candidates. Secondly, to ask yourself, "Is this the sort of man that I should like to have serving under me at a small hospital with only one N.C.O. and two or three privates?" If not, why should you send him to one of your brother officers? Remember also, that all extensions of service from three to seven years, and from seven to twelve years, are strictly limited, and from the latter we have to select all our senior N.C.O.'s and warrant officers, and you will realise how much you may help the officer in charge of Records, with whom the decision rests, by your recommendations or refusal to recommend as circumstances require. We *must* be guided in our office mainly by recommendations from officers commanding who *know* the men personally, while we can only know their official records.

The position is interesting, but the scheme has not been in working order long enough to enable me to form any decided opinion; it is undoubtedly an application of the Darwinian theory of the survival of the fittest in a severe form, and should give us in a few years the finest senior N.C.O.'s and warrant officers in the Army.

Now let us turn for a moment to the other end of the soldier's career. A large number, the great majority in fact, cannot extend and must go to the reserve. Will you try to help them and see that they understand what they must do on joining the reserve and how they can best obtain

employment? I am in daily correspondence with these men, and I am often astonished how little they know when they put on their civilian clothes and walk gaily out of barracks into the world outside—a world which is over-full of unemployed men already. The letters I get are pitiful. The men lose their postcards (A.F.D. 424); they do not report themselves and forfeit their reserve pay; they have no work and do not know how to get it; they want to get back to the Army, any branch if they cannot come back to us, and are often in great distress. I would ask you and all officers, when men are going away, to take a personal interest and see if they really know what they are going to do and how they are going to do it. Do not leave it all to the staff-serjeant, however good and capable he may be. I am quite aware that the men themselves may resent advice. They have been well fed and clothed for several years; they have money in their pockets and are quite ignorant of the competition and pressure in the industrial world. The instructions they receive are quite clear if they are explained to them, but they will learn far more from a few words from an officer than they will from their printed instructions which they stuff into their pockets and never read. There is a short notice in a recent Royal Army Medical Corps Journal on the subject of obtaining employment if you will look at it. We are a branch of the National Association for the Employment of Reserve and Discharged Soldiers for our own Corps, but it is not much use registering men in this branch for unqualified labour. For trained men, dispensers, valet attendants, masseurs, &c., &c., we are fairly successful in obtaining billets, but the untrained men had better register in the districts where they intend to reside.

Finally, for those who fall by the way, or for those who leave widows and children behind them, there is our own Corps Fund, which though small is steadily increasing, and has already done good service towards relief of distress and the education of children. It is supported by grants from canteens and recreation funds and also by a donation from the Royal Army Medical Corps Fund to which we all subscribe. For the men with whom you are serving, those who like the Army and who wish to stay in it as long as they can, you can do a good deal if you care to try. You have already had some experience as to what is done at the Depôt, and if you look at the Corps News, which is published every month in the Journal, you will see accounts from stations at home and abroad of good football teams, good cricket elevens, good sports, entertainments, and recreations of all sorts; and where this is the case you will find good companies and very little crime. And those who are ambitious to rise—and they are many—you may be able to help with a little kindly advice and explanation. The new standing orders have hardly been published a year, and since then a pamphlet has been issued modifying the courses of instruction in the nursing section and facilitating the advancement of really good men. The main point to drive home is this: Our powers of extension

of service are so limited that we can only accept *the best*, and if a man wishes to remain in the Army to earn a pension or to obtain promotion to warrant or commissioned rank he must qualify in some special subject, or pass the ordinary examinations of the Corps, and the sooner he does so the better, or he will be swept into the reserve with the rest. This is the age of examinations, as you know to your cost, and as the pathway is narrowed it is a case of the—reserve take the hindmost. Perhaps a little fellow-feeling may induce you to direct the ambitious young private or N.C.O. in the way he should go.

I have avoided going into wearisome details and have only tried to indicate some of the main points which may be of use to you in your future service; and it should not be forgotten that it is *one service*, one badge, one motto, one uniform, and that the head is not much use in peace or war unless it has trained hands to assist it in carrying out instructions.

Reviews.

War Songs. Selected by Christopher Stone. With Introduction by General Sir Ian Hamilton. Clarendon Press. Pp. xvii. and 188. Price 2s. 6d.

This is a collection of nearly a hundred songs and ballads, many of them rescued from the obscurity of ballad books and archæological collections, arranged in chronological order of composition. They range from "Bannockburn" and "Otterburn" to "The Red Thread of Honour" and "The Private of the Buffs" of Sir F. H. Doyle. "Soldiers' Songs" would have been a more fitting title, as, with the exception of "The Sea Fight at Sluys," exploits on land only are dealt with; the compiler having collected "Sea Songs and Ballads" in a companion volume. Many of these poems, such as "The Burial of Sir John Moore" and "Hohenlinden, would hardly be called songs; and, as Sir Ian Hamilton tells us in the introduction, with four or five exceptions, they are caviare, not perhaps to the general, but certainly to the soldier. He adds that it is well they should be published to keep alive old associations and sentiments, and to teach us, in these days of Peace Conferences and Millennium Dreamers, how our ancestors jeopardized their lives and found it more a matter for joy than lamentation.

The Army as a whole, he says, although lukewarm, as compared with German and Russian troops, about singing themselves, are always glad—eager, indeed, would be the better word—to listen to the singing of others; and that they like a good soldier song most of all, though they have few opportunities of knowing the best. Of this he gives several striking instances. He regrets the abyss into which we are being lured by our music-halls, and shows how soldiers still greatly appreciate songs which are innocent and touching, especially if generously seasoned with sentiment.

As to nationality, the Scotch are far more in touch with their old songs than the English. Though "Scots wha hae," "The March of the Cameron Men," "The Blue-bells of Scotland," and "Bonnie Dundee" may not be sung on the march, yet they are as the very breath of their life to the Scottish soldier. But who can say that the Englishman is unimpressionable and unmusical after the experience of the Royal Fusiliers! In the early nineties there was composed an inspiriting song, "Fighting with the 7th Royal Fusiliers," which produced such an overwhelming rush of recruits that the authorities could easily have raised several additional battalions. As it was, recruiting for the regiment had to be closed for the year, at a period when enlistment otherwise was slack. Regiments from the North of England are more musical than those from the South, and battalions recruited from the towns are better songsters than those from the country. The Manchester Regiments are, as English corps go, exceptionally clever at singing on the march; but as a rule the corps which have local march tunes, though proud of them, do not seem to care to sing them. Even so fine an air as "The Lincolnshire Poacher" has no enduring success in this respect. The Suffolks have seldom, if ever, been known to break into song; whilst, according to Sir Ian, the Somersets, though cherishing their old county songs, need rain, and plenty of it, to bring them out.

Welsh soldiers are extremely musical, though dwelling more on the pathos of war than on its glories. A Welsh Militia battalion on Salisbury Plain in 1899 used to sing all day and most of the night; but whether the songs were war songs or love songs it would be impossible for anyone but a Welshman to say.

The Irishman, in his irresponsible *abandon*, can find fun and frolic even in the bloody drama of the battle-field :—

> His spirits are high, and he little knows care,
> Whether sipping his claret, or charging a square.

But the Irish songs sung in the Army are many of them modern, and have worked their way back from America. They are very popular at "gaffs," where it is not unusual to put regimental words to some such tune as "The Mulligan Guards." There is another American-Irish tune to which are set several different word versions, such as "Slattery's Mounted Foot." Yet if anyone has the courage to rise and sing "The Minstrel Boy," or "She is far from the Land where her Young Hero Sleeps," the spell of the red thing catches hold, and the singer will reap his reward.

The introduction adds very greatly to the value of this well-got-up little book. J. T. C.

The Etiology and Nature of Cancerous and other Growths. By W. T. Gibson, A.R.C.S. London: John Bale, Sons and Danielsson, Ltd., 1909. Pp. xv. and 123. Price 6s. net.

We are not aware of the significance of the letters after the author's name, but the work before us shows that he has no knowledge of scientific methods, and no sense of the ridiculous. His thesis appears to be that "decomposition products, including alcoholic liquors, are direct agents in the causation of cancer." To convince us of the truth of this theory we

expect to find some experimental evidence. Instead of this, we have pages of irrelevant and often incoherent matter, of which the following, taken at random, is a sample :—

"Commercial Traveller [Cancer, 72 (51), 67 (63); Alcoholism, 26 (15), 21 (16)]."

"The commercial traveller respires the air of licensed premises to a considerable extent. For more than one reason, railway journeys induce constipation, and in going his rounds the traveller is at a disadvantage in obeying the calls of Nature." C. B.

Syphilis: Its Diagnosis, Prognosis, Prevention, and Treatment. By T. P. Beddoes, M.B., B.C.Camb., F.R.C.S.Eng. London: Rebman, Ltd., 1909. Price 5s.

In "Syphilis," by Mr. T. P. Beddoes, we are given a treatise of 220 pages, based on civil practice at the London Lock Hospital and the London Hospital for Diseases of the Skin. A large amount of valuable information is condensed in small compass: "If we consider syphilis in relation to other diseases its importance becomes more manifest, and any advance in our knowledge of the disease will aid in unravelling many, if not most, of the mysteries attaching to other diseases. Indeed, so much has mankind to gain by its extermination that every serious attempt towards this end should be encouraged and watched with careful attention." The author considers that "probably syphilis is as old as the human race." That it is ancient is evident, we think, from the mere fact of the Jewish ritual of circumcision, which unquestionably largely prevents the occurrence of this far-reaching disease. The author is in error, however, in stating in regard to Europe that "an epidemic resembling syphilis was first observed during the siege of Naples in 1493, the observation being due to the acuteness of the Italian physicians." It has been proved beyond dispute that syphilis was first introduced into Seville, Spain, by the crews of Columbus from the West Indies (Haiti), the disease being called "Serampion de las Indias" (West Indian eruption), then to Barcelona, then to Italy from Spain on the occasion of the campaign of Charles VIII. The disease was well recognised, and named amongst the Aztecs in Mexico and on the adjacent mainland of Central America.

The natural tendency to cure in syphilis is exemplified on p. 4 by the statement, "that unlike most cellular infiltrations there is no tendency to organisation, but, instead, to retrogression by fatty degeneration and absorption, or by necrosis and consequent ulceration." Possibly we have a clue here to the *role* played by mercury and potassium iodide in syphilis, as these drugs, by their depurative effect on lymphatic glandular tissue, tend to assist the natural process. They thus permit the blood and tissues to exert to better advantage their phagocytic and other powers when the general health is adequately maintained. Mercury, therefore, would appear not to be a direct bactericide, as is commonly claimed, but indirectly bactericidal.

Non-infecting chancre is, we think, a better term than soft sore or soft chancre. The author advises the use of non-irritating antiseptics in the local treatment of chancres. Carbolic and perchloride of mercury lotions are irritating. He strongly advises tincture of iodine (a teaspoonful to

1 pint of water) or cyllin (1 in 200). Lotio nigra, with or without iodoform, is also, we consider, much superior to carbolic or perchloride lotions in rapidly effecting the resolution of the sore. Reference is not made to treatment by X-rays in judiciously selected cases, which is probably superior to all methods.

The author draws attention to an important point in the operative treatment of buboes in association with non-infecting or infecting venereal sores. He states: "Necrotic tissue should be removed, but not more gland tissue touched than is absolutely necessary, because the glands are a means of defence against organisms invading the system. To remove them is to expose the system to severe infection if a sore or wound subsequently forms on the area drained."

We cannot agree with the statement on p. 42, "that a syphilitic roseolar rash can come out within one month from infection," nor with the further statement on p. 43, that "these two (erythematous) rashes characterised by redness (erythema) alone usually last a month or two after taking mercury, and from two to four months if not treated." We consider that the initial rash in syphilis, whether roseolar, papular, or pustular, rarely, if ever, occurs under three to four months from infection, and "erythematous" rashes usually disappear within two weeks or so, either with or without treatment, although a reminder rash may occur at a later date.

In regard to treatment, the author considers that "in England treatment by the mouth is sufficient for cases of average severity," and that intramuscular injections "are not free from dangers as deaths have occurred, though chiefly from giving too large doses. Care is requisite, otherwise the diarrhœa may be attributed to some other cause, and already debilitated patients may become exhausted and succumb. Injections should be stopped as soon as either albumen or sugar is present in the urine. Sometimes insoluble injections become encapsuled painful lumps that take weeks or months to be absorbed. Even when injections are stopped on account of stomatitis, mercury still continues to pass into the system until the stomatitis becomes serious, and there is also colic and diarrhœa so that it is necessary to excise the lumps." The "needle should be inserted into the muscle separately or detached after insertion," in order to guard against embolism in the lung. Speaking of calomel injections, the author states that "it is best to use sterilettes, as calomel cream, even more than grey oil, is unsatisfactory and dangerous when it has been once warmed and allowed to cool."

Comparing soluble and insoluble injections, the author states, "the sublimate is satisfactory and potent, succinimide is less effective, cyanide is rapid but evanescent, and most useful in early cases, sozoiodolate in later, while basic salicylate has most of the advantages of grey oil." The author considers the inunction method "specially suitable for syphilis of the brain, spine, and eye in patients confined to bed or under continuous observation. Unlike injections it is quite painless, and patients under it put on more weight than under any other treatment; also, it is less likely to cause digestive disturbance or stomatitis, and is advisable when mercury in any form cannot be absorbed by the intestinal tract, or disorders the stomach and bowels. It is advantageous for debilitated patients in either the secondary or tertiary stage, as it leaves the stomach free for quinine, iron, and other tonics."

Atoxyl "is not sufficiently intense for late secondary rash or for iritis." This would appear to be an argument against its employment, especially as "intolerance is shown by nausea, vomiting, and diarrhœa."

The author states on p. 145, "when a man is infected marriage or conception is permissible one year after the last sign, treatment being continued as before mentioned." It is not stated what the last sign is, but the limit appears to us to be a short one if it refers to secondaries. Fournier, in France, we believe, considers five years a minimum, and it is certainly a wise one to recommend.

Tersely written, well considered, and thoroughly up-to-date, the book can be strongly commended to students preparing for examination and to practitioners whose time precludes reference to larger manuals. The book is shortly indexed, but a bibliography would have improved its usefulness.

H. C. F.

The Food Inspector's Handbook. By Francis Vacher, Medical Officer of Health for Cheshire. Published by the Sanitary Publishing Co., Ltd., London. Pp. xxiv. and 268. Price 7s. 6d. net.

The fifth edition of this very useful book shows an increase on the last issue due to the fact that meat inspection is attracting a larger share of attention year by year. It is hardly necessary to praise a book so well known as this excellent manual is. It can confidently be recommended to officers of the Corps who intend to take up sanitation as a speciality, not merely for examination purposes, but for subsequent reference. Its value to officers of the Supply and Transport Corps who wish to have a convenient handbook on this subject would also be very great.

C. H. M.

A System of Syphilis. In six volumes. Edited by D'Arcy Power, M.B.Oxon., F.R.C.S.Eng., and J. Keogh Murphy, M.D., M.C.Cantab., F.R.C.S.Eng. With an introduction by Sir Jonathan Hutchinson, F.R.S. Vol. i., pp. xxxv. and 380, with 68 plates. London: Hodder and Stoughton, and Henry Frowde, 1908. Price £2 2s. net per volume.

So much work has been done in recent years on the subject of syphilis, and so greatly has our knowledge of this very complicated disease been increased, that the appearance of a new work on this disease is not surprising; the volume cannot fail to arouse the interest of all those who are interested in this very important subject, for it is a long time since a work of such merit and importance has been published.

A book on syphilis, which has as contributors the names of Sir Jonathan Hutchinson, Professor Elie Metchnikoff, Dr. Iwan Bloch, Dr. F. W. Andrewes, Colonel F. J. Lambkin, Dr. Arthur Shillitoe, and Dr. G. F. Still, is one the value of which will be appreciated by all.

The introduction, which is written by Sir Jonathan Hutchinson, contains most valuable information, and he especially refers to the influence which Schaudinn's discovery has had on diagnosis and treatment, though, at the same time, he utters a word of warning that caution must be exercised with regard to experiments proving the communicability to apes and monkeys, and suggests that the inferences must not be too hastily accepted.

In a series of what he calls "detatched paragraphs," he touches on those subjects connected with the disease about which, at the present time, we have scant information. One has only to read these to realise at once how much is waiting investigation on this subject.

It is interesting to note that the praise which arsenic has recently obtained in the treatment of syphilis, Sir Jonathan Hutchinson attributes not so much to its influence on the parasite as to its well-known power of controlling most forms of chronic dermatitis. We cannot, however, quite indorse this, having in view our experience with arsenic in the form of the arylarsonates, which acts like a specific and undoubtedly influences the primary lesion.

Next follows the history of syphilis by Dr. Iwan Bloch, whose knowledge on this subject is well known. He produces facts and quotes recognised authorities which prove that it was between the years 1493 and 1500 when syphilis first appeared in the Old World, and that it was brought into Europe from Haiti by the sailors who accompanied Columbus on his first voyage, the majority of whom contracted syphilis and returned sick to Spain. It was then spread all over Europe by the army of Charles VIII. of France, who, when preparing for a great campaign, attracted mercenaries from neighbouring countries, among whom were many Spaniards and English soldiers. Bloch unmistakably proves that syphilis did not exist in the Old World prior to the pre-Columbian days, in spite of many arguments that it did, and the mass of evidence and the authorities he quotes make most interesting reading for those working at this subject. Then follows an account of the early and later history of syphilis in Europe, with a full bibliography on the subject.

The next article is certainly the most valuable one in the whole volume—viz., The microbiology of syphilis, by Professor Metchnikoff. This is an article which no one should fail to read, for it is full of interest and information. First, he gives a brief historical account of the work which was done by various men and the organisms which they claimed as being the so-called cause of syphilis. This leads up to a description of the circumstances which resulted in the fascinating discovery of the spirillum of syphilis by Schaudinn and Hoffman, who were acting as members of a commission of experts appointed to study the question from all sides; and suggests that it was particularly fortunate for science that the discovery of the etiology of syphilis fell into the hands of a man like Schaudinn.

Professor Metchnikoff then gives, in three chapters, an account of the principal results obtained up to the present time: the occurrence of the *Spirochæta pallida* in syphilitic lesions; the topography of the *S. pallida* and its connection with the cell of its host; and phagocytosis in syphilis and the natural history of the micro-organism. There is also a most instructive chapter on the methods necessary for staining and examining the spirochæte in fresh preparations, for which the author recommends the method of Landsteiner and Mucha, who have applied the principle of the ultra-microscope of Siedentopf and Zsigmondy for the examination of small particles in a dark field. To do this they use a condenser made by Reichert, of Vienna. The illumination is given by an arc lamp of 20 ampères. The most satisfactory combination of lenses has been found to be that of a dry objective, No. 5, with Reichert's

compensatory ocular, No. 18. Professor Metchnikoff says, "this very interesting and convenient method may now be considered as a necessary part of daily practice and relegates staining films to a second place." He also gives minute instructions of the technique necessary for examining various tissues, the blood, and glands for the *S. pallida*, and for staining the same by various methods.

Another chapter is devoted to criticisms as to the part taken by the spirillum of Schaudinn in the causation of syphilis, and this is followed by one on the practical application of the recognition of the organism of syphilis and a bibliography. The whole article is one of such importance that it should be read carefully by all officers of the Royal Army Medical Corps. It is illustrated by some beautiful plates, the films for which were lent by Lieutenant-Colonel Leishman.

The next article is on the general pathology of syphilis by Dr. F. W. Andrewes, and here again we have a most valuable contribution, which is most interesting and instructive, going as it does into the subject in a most complete way. The chapter on immunity deals with such up-to-date subjects as serum diagnosis and Wassermann's reaction, which is fully explained and described; while in a few words on artificial immunity he expresses the hope that protection will follow the employment of an attenuated virus as a vaccine.

Colonel F. J. Lambkin's long military experience entitles him to speak with authority on the subject of primary and secondary lesions as seen in the male, which he does very fully, and one has only to read his article to realise how difficult the primary lesion is to diagnose.

Dr. Arthur Shillitoe describes the primary lesions and early secondary symptoms as seen in the female, and following on the previous article, the description is valuable as showing how the disease varies in the two sexes. Dr. Shillitoe states that the primary lesion is sometimes most difficult to find, while, on the other hand, it is extremely common in women to find multiple primary lesions.

These last two articles are illustrated by the aid of beautiful plates from direct colour photographs, taken by Mr. Tubbs and Dr. Arnold Moritz; this process has been used for the first time and shows clinical conditions in a way hitherto unknown.

The final article in this important volume is by Dr. G. F. Still, who treats the important subject of congenital syphilis in a very complete way.

This volume is such a valuable contribution to the literature of syphilis that we must congratulate all concerned in its production, and the succeeding volumes will be awaited with interest. W. A. W.

System of Syphilis. By D'Arcy Power and J. Keogh Murphy. Vol. ii., pp. 387. Oxford University Press: Henry Frowde, and Hodder and Stoughton, 1908. Price 42s.

Vol. ii. of "A System of Syphilis" is the second of a valuable series of six large volumes on one of the most important subject in the domain of medicine.

The "Surgery of Syphilis" is admirably delineated in fifteen chapters, by Mr. D'Arcy Power, of St. Bartholomew's Hospital, and thirty-five beautifully executed plates illustrate his article. Syphilitic affections of the bones, joints, muscles, teeth, mouth and tongue, &c., are fully

described. Prophylaxis and the experimental work of Roux and Metchnikoff are discussed, exemplified by cases and control experiments given in detail. Methods of treatment by inunction, mercurial vapour baths, iodides alone and combined with mercury, intramuscular injection of mercurial and arsenical salts, are dealt with in four chapters. Reference is made to recent works on the subject, both English and Continental. Mr. D'Arcy Power expresses the general opinion of the profession in saying "that there is no true cure for syphilis without the use of mercury." The treatment of syphilis by inunctions in courses on the chronic intermittent plan is considered "often highly satisfactory; a patient who has borne internal administration of mercury badly, begins to increase in weight, appetite returns, the digestion improves, he sleeps well at night, and ceases to be listless." The author considers that intramuscular injections of insoluble grey oil "come next in convenience to the administration of mercury by the mouth as a cure for syphilis," but the statement on p. 222, "that it is equal in efficacy to the method of inunction," conflicts with that on p. 210, "that the method of inunction is especially indicated in severe syphilitic lesions of the central nervous system, of the larynx, the viscera, and the eye; also for manifestations which prove rebellious to other methods of treatment, as in cases of leukoplakia and fissured tongue, and in persons who cannot take mercury by the mouth, and in children."

The next portion of the book by Colonel Lambkin, R.A.M.C., deals with the "Treatment of Syphilis" in nine chapters of seventy-six pages. The author gives a lucid description and history of the intramuscular injection of insoluble salts of mercury, more especially insoluble grey oil, which is largely used in the British Army as a service convenience for the weekly treatment of out-patients. Colonel Lambkin contrasts the various methods of treating syphilis, and considers the therapeutic effects of the ingestion method "far inferior to those of the inunction method." He finds that "in the majority of cases after mercury had been administered by the mouth for six weeks to two months it began to disagree in one way or another." This period, however, appears to us to be somewhat long. Cabot has conclusively proved that "if blood counts be made it will be found that the count of red cells and the amount of hæmoglobin increase during the first three weeks of mercurial treatment begun when secondary manifestations of syphilis have first occurred. After that time, if mercury is still given, the hæmoglobin, and later the number of red corpuscles, begin to decline." Clinical experience amply endorses the extreme value of short defined courses. Professor Fournier, in Paris, it is stated, "employs almost entirely the ingestion method." This is in consonance with Sir Jonathan Hutchinson's treatment in London, who also exclusively uses the ingestion method and prescribes grey powder, not because he considers it more valuable than inunction, but because he finds it more convenient in treating private patients. Colonel Lambkin states that "inunction is the oldest known method of administering mercury," and says "it has always been an enigma to me why England has not taken the example of Aachen, or Aix-la-Chapelle, for there during the last century and a half the inunction method has flourished in the most successful manner."

Scarenzio, in 1864, it is stated, used calomel for injection purposes,

"but owing to certain accidents which generally followed, it had to be abandoned." For twenty years the author has been using the metal itself (in the form of insoluble grey oil) in preference to all other salts of mercury, and he maintains that although the therapeutic intensity of metallic mercury is probably not as great as that of calomel, it easily holds premier place in the treatment of syphilis from a curative and preventive point of view. The metal "is better tolerated and the lasting effects are much more marked." In regard to salicylate of mercury, Colonel Lambkin has used it extensively, but "has long since given it up as being far inferior in every respect to metallic mercury or calomel."

In recapitulating the facts concerning metallic mercury (grey oil), Colonel Lambkin considers "its one disadvantage is that should salivation take place after an injection it is a difficult matter to prevent the symptoms getting worse unless the mercury is removed. This has been done by excision, but the operation to effect this is as difficult as it is serious."

The author states that "intramuscular injection has never found favour in England and her world-wide Empire, the exception being in her Army, where since the year 1889 it has been gradually pushing its way through. The brilliant results which have been attained, especially in India, where during the last decade admission to hospital for syphilis amongst British troops has fallen from 400 per 1,000 to 110 per 1,000 as the result almost entirely to the adoption of the intramuscular method of administering mercury."

We cannot agree with Colonel Lambkin's figures. In India, in 1897, amongst British troops, the disease (syphilis) truly reached the highest ratio on record. The admission ratio per 1,000, in 1897, for secondary (constitutional) syphilis amongst British troops in India being 106·2 per 1,000, and for primary syphilis 125·6 per 1,000 (*vide* table last column on p. 291, "Army Medical Department Report," 1897). Owing to numerous errors of diagnosis under the heading primary syphilis, the plan of collecting venereal statistics in the Army was wholly altered in 1904, diagnosis being much more carefully safeguarded, and the term primary syphilis was entirely done away with. The terms now used are "syphilis" and "soft chancre." In India, in 1907, the admission ratio per 1,000 of strength for syphilis is 22·2; for soft chancre, 19·7 per 1,000; and for gonorrhœa, 48·0 per 1,000 (*vide* "Army Medical Department Report," 1907, p. 109).

In India, syphilis steadily increased in the Army from 1889 to 1897 owing to the cessation of control of diseased women from 1888 and in despite of treatment of soldiers, but in 1897 the control of diseased men and women again commenced by legal enactment, namely, the Cantonment Act, October, 1897. In 1903, the attendance of soldiers as out-patients for syphilis was made compulsory throughout the British Army at home and abroad, and re-admissions to hospital for lapse of disease lessened. We consider, therefore, that the brilliant results in the Army, by means of which a great reduction in all forms of venereal disease (including gonorrhœa and soft chancre) has been effected, are principally due to the above preventive control, to more careful and prolonged in-patient treatment in hospital in the earlier contagious and more remediable phases which limits the local spread of disease, as well as to the united efforts of Army

Medical Officers over a series of years rather than to any special mode of treatment. Further, in a recent valuable report (August 31st, 1908), on sixty-four stations visited in India by Major A. P. Blenkinsop, R.A.M.C., it is shown by statistics on p. 11 that relapses of syphilis with consequent re-admission to hospital in the years 1906-07 were much more frequent under intramuscular injection of insoluble grey oil than under other methods of treatment, such as inunction or ingestion.

The organic compounds of arsenic in syphilis, more especially soamin, are shortly discussed, but Colonel Lambkin considers "it far too soon to express an opinion as to whether arylarsonates are likely to prove of permanent benefit in syphilis."

The admirable historical account of syphilis in a virgin soil (Uganda) forms an interesting ending to Colonel Lambkin's contribution. The concluding chapter, "Syphilis in Obstetrics," is shortly dealt with in sixteen pages by William J. Gow, M.D., Physician to Queen Charlotte's and St. Mary's Hospitals. A little more space could have been well devoted to this important subject. The question "whether a mother free from syphilis can be infected by her child *in utero* must still be regarded as a disputed point." The views of Fournier, in France, and Hutchinson, in England, are extensively referred to in connection with the whole subject of syphilis in obstetrics. It is considered "generally advisable to give mercury during some part if not the whole part of pregnancy, in cases where there are no symptoms but where a previous history of syphilis is obtained."

The book concludes with a good index. The printing and publishing are considerably above the average, and the work can be confidently recommended.

H. C. F.

Current Literature.

The French Military Medical Manœuvres. (*Le Caducée*, September 19th, 1908, p. 244.)—This article is written for the purpose of drawing attention to the innovations that have been made in the Medical Service within the last year or two.

The regulations of 1892 are about to be replaced by others which have been tried at the great manœuvres. These new regulations have greatly altered the arrangements for the fighting line, but those for the line of communication have been left alone except for a few details. For this reason the Technical Director of the manœuvres near Paris, Méd.-Principal First Class Schneider, directed all his attention to instructing the *personnel* and developing the Medical Service for the lines of communication, more especially in connection with the wheeled transport.

The three Red Cross Societies took part in the work, the "Société de Secours" preparing an "*infirmerie de gare*," the "Dames françaises" organising an auxiliary field hospital, and the "Femmes de France" an auxiliary territorial hospital, all of which were most satisfactory and of the greatest assistance.

The new technical points introduced during these manœuvres come under three headings: (1) Transport; (2) Hygiene; (3) Search for Wounded.

(1) *Means of Transport.*—Heavy motor wagons and lorries were tried and found to be very satisfactory. One can carry as much as eight horses and several wagons, and they are much faster, get over bad ground well, and are easier to load and unload. They should, however, only be used for the transport of material, and not of wounded (except, perhaps, those who are able to sit up), as they shake a good deal. All possible means of transport of wounded were tried and compared. The most interesting of the criticisms made was that of Major-General Taverna on permanent ambulance trains. He thinks that the number of these should not be increased, not only because they are costly and expensive to maintain in times of peace, but because their functions are satisfactorily filled by improvised trains. The latter are much cheaper, because they can be sent up to the area of operations filled with material and ammunition, and can be sent back filled with sick and wounded.

(2) *Hygiene.*—For the first time kitchens on wheels (which were of so much use during the Manchurian campaign) were tried. They will be tried again at the great manœuvres, but at present they seem rather open to criticism, as some are not steady enough, while others are badly mounted or too high. If these defects can be remedied, these kitchens will be of the greatest use to medical units, as they simplify the task of preparing food and better meals can be served.

Analysis of Water and Food.—This was carried out by Pharmacist Major Rothéa, and gave most interesting results. He furnished the medical units with hot water and with tea, and while this was being done he proceeded to analyse the water and milk, with the result that the water was found to be unfit for drinking and the milk to be skimmed. This shows how important it is that a pharmacist with an analysing outfit should be attached to each medical unit. Major Rothéa had with him a Lapeyrère filter and Vaillard-Georges water-sterilising soloids, and these were used for rendering the water potable.

(3) *Search for Wounded.*—An interesting experiment was carried out by Dr. Rudler with a dog trained to search for wounded. A man was hidden in some rough country and the dog was then sent off to find him. This he did at once, barking until assistance arrived. Medical Inspector Mareschal, in view of his experiences in Madagascar, is of opinion that such dogs are absolutely necessary in colonial wars.

W. G. M.

The Use of Motor Vehicles with the French Army Medical Service. By Méd.-Major Dommartin. (*Le Caducée*, September 20, 1908, p. 247.)—Field hospitals are no longer, like ambulances, an evacuation unit; they are regular hospitals where wounded must be treated and cared for on the spot until they are better or until evacuation can take place. They should reinforce the ambulance during a battle and take its place directly afterwards, be in touch with the line of communication, and form a reserve of *personnel*. At present, however, the organisation of the field hospital does not permit of its filling all its functions satisfactorily.

To begin with, its material is insufficient; it has not enough means of transporting wounded. It has vehicles only for its material and

personnel: that is to say, four wagons for material and two for the *personnel.* Again, in an area traversed by one or more army corps, it is impossible for the field hospital to obtain wagons for transporting its food and the bedding which is indispensable to it. Also the tents, &c., which should be sent up for it, do not arrive until after considerable delay. All these necessaries should, however, be supplied without delay, and not be submitted to the uncertainties of campaigning.

According to the normal order of march, a field hospital is placed at the end of the supply column. In this position it is 24 kilometres from the advanced guard, that is to say, six hours march from the field of battle; and its material would probably take nine hours to reach the battlefield. Thus a field hospital cannot begin its work till the evening of the fight, or perhaps the next day, and for many hours its *personnel* are left idle, when their assistance at the ambulance would be of the greatest advantage.

Further, the length of a field hospital in column of march is 60 to 80 metres, taking two minutes to pass a given point. Each wagon is harnessed to two horses and carries 800 kilogrammes of cumbersome material. This formation is, therefore, not very mobile and makes a column bulky. The delays and difficulties that result from accidents to the wagons, horses, &c., are numerous, and it is plainly evident that it would be more desirable to have motor traction for the field hospital than for the ambulance. The field hospital should be as mobile as the ambulance; it should be always ready to march and capable of getting quickly to the field of battle.

All that is needed is to replace the four medical service wagons (*fourgons*) by two motor lorries, each carrying 2,000 kilogrammes. Such a lorry, carrying the contents of two wagons, is fairly light and could travel at a rate of 12 to 15 kilometres per hour, which would triple the speed of the horse-drawn field hospital. One large motor omnibus would suffice for the *personnel.* To make the equipment complete for modern requirements, a Panhard car carrying an autoclave for sterilising dressings, with a radiographic installation and an electric search-light, such as has been designed by M. Caeffe, might be added; also a field kitchen. The large motor lorries could also carry stretchers, bedding, and other material, such as food. Two would be sufficient for these purposes. The sick attendants could be carried in a motor omnibus, and ten lorries should be added for the transport of sick and wounded.

Thus composed, the field hospital would be a self-contained and independent unit. Freed from dependence upon military supplies or local resources, it would never be put out of action by untoward circumstances, and could always be in close proximity to the troops, a state of affairs that is rarely possible under present conditions. It would be enabled perfectly to fill its *rôle* as a unit for replenishing the material of the regimental medical service, &c., because of the speed at which it could travel; in forty-eight hours it could itself be replenished, and the tents and shelters sent up from the line of communication would arrive at the right moment.

While the ambulances would march with the fighting columns, the field hospital could march with the rearguard, and even remain several days behind. The distance, however, should never be more than 80 to 100 kilometres behind the fighting line, so that the field hospitals could be brought up at any time they were required.

In this way the field hospitals would not block the roads leading to the fighting line, the army corps or division would be freed from its hospital reserve, and the field hospitals would be made thoroughly mobile.

This change of traction would require, in order to replace the transport material of field hospitals now in use, fourteen motor lorries, one touring car, and one motor omnibus for *personnel*. This would render the field hospitals quite independent and prepared for every emergency, Their usefulness would be so enormously increased as to recoup the expenses of the change.

W. G. M.

Recent Publications concerning Recruiting Statistics in Germany and other Countries. (*Deutsche Militär. Zeitsch.*, August 5th, 1908.)—A dispute has been going on in Germany as to whether the greater percentage of recruits fit for service are furnished by the urban or by the rural population. This has had the effect of arousing general interest in recruiting questions and statistics.

Since 1902 the State has ordered that the attestation sheets of a recruit shall show whether he is a townsman or a countryman, and whether, in each case, he has been employed in forestry or agriculture or in commerce or any specific trade. It has not, however, been possible to supply details with any regularity or reliability. The distinction between town and country (any place with less than 2,000 inhabitants being reckoned as country) is too rigid to be applicable in all cases. Also the record of occupation is insufficient for a thorough study of recruiting statistics, as it makes no allowance for the changes of occupation which often take place; and again, various occupations which are more or less alike are apt to be entered under one heading without further particulars. It is of great importance to know these, as a man's occupation has great influence on his mental and physical development. The stronger a man is the more likely he is to be able to take up responsible and useful work.

Government statistics have only been able to establish the following percentages, which are the average of the returns for 1902, 1903, 1904, and 1905, of fitness for military service amongst the classes of recruits examined:—

Countrymen	employed in agriculture, &c.	59·14 per cent.
	otherwise employed	58·17 ,,
Townsmen	employed in agriculture, &c.	57·82 ,,
	otherwise employed	51·94 ,,

It has been decided in Germany that in future full details of each soldier's birth and occupation, and parents' occupation, shall be entered, so that satisfactory recruiting statistics may eventually be obtained. Meanwhile, various efforts have been made to get at the truth, and in 1905 several works on the subject were published. Those of Roese and v. Vogl may be mentioned, and Kueziaski published a pamphlet upholding his theory that the army is now mainly recruited from the urban population, as only about one-third of the recruits are engaged in agricultural employment. In reply to this pamphlet Abelsdorff endeavoured to find fresh material from enquiries made in several trades, such as printing, upholstering and metal working. He ascertained how many out of two generations had been in towns, and how many in the country. The following figures show his conclusions. Out of every 1,000 workmen who had been examined as to fitness for service, the following percentages are shown:—

In places of	First Generation		Second Generation	
	Born in	Grown up in	Born in	Grown up in
Up to 5,000 inhabitants..	51·3 (49·4)	.. 43·3 ..	25·8 (21·2)	.. 16·3
5,000—100,000 ,, ..	34·1 (33·4)	.. 30·7 ..	26·7 (25·4)	.. 23·1
Over 100,000 ,, ..	14·6 (17·2)	.. 26·0 ..	47·5 (53·4)	.. 60·6

The figures in parentheses and those in the "grown up in" columns refer only to the Berlin workmen amongst whom Abelsdorff made his enquiries. Of these numbers the following have not served in the army:—

Place of birth	First generation	Second generation
Under 5,000 inhabitants	53·4 per cent.	62·8 per cent.
Between 5,000 and 100,000 inhabitants	58·2 ,,	67·0 ,,
Over 100,000 inhabitants	61·1 ,,	69·7 ,,

This shows that the larger the town the greater the number of the unfit, and that the unfitness has appreciably increased with the second generation.

A work recently published by E. Wellmann is a report upon the answers received to enquiries made amongst 2,943 Berlin workmen employed in every kind of trade, with regard to the place of birth of parents, where they were educated, occupation of the parents as well as of their sons, military service of father and son, family circumstances, whether the women are engaged in work, number of children and percentage of deaths among the children. Wellmann's figures also bring out the extent of the migration into towns that is taking place; thus, of the first generation (of the fathers of those interrogated) only 6·4 per cent. were born in towns; while out of the second generation 17·9 per cent. were townsmen. He has also discovered that the more unskilled the nature of the labour, and the lower the social position of the workman interrogated, the more frequently was his father engaged in agricultural employment alone; while the more skilled the labour of the son, the more frequently had his parents followed other than agricultural pursuits. All the more remarkable are the figures he gives, which show how unfitness has decreased:—

Of the fathers	43·9 per cent.	were fit.
Of those interrogated	46·0 ,,	,,
Of the sons of those	51·6 ,,	,,

This shows, contrary to Abelsdorff, that fitness has increased in spite of the tendency of the population to migrate to the towns. This increase depends very much, however, on occupation. This favourable result may partly be accounted for perhaps by Wellmann's researches having been undertaken during particularly healthy years; and also by the fact that in 1897 the standard of height was lowered to 154 to 157 cm.

We need not, however, accept all Abelsdorff's and Wellmann's conclusions. For one thing the answer to their query as to whether the father served in the army or not may well have been in the negative without implying that the father was unfit. Comparatively fewer recruits were then required as the army was not so large; also, we must remember that many infirmities then a bar to military service are not now so regarded. Their enquiries, however, have procured valuable material, especially with regard to the percentages of marriage, number of children, women's work, &c.

Most writings during the last few years on such subjects have been

controversial, but in an article which appeared lately in the *Zeitsch. f. Sozialwissenschaft*, on "The Percentage of those fit for Enlistment as a Standard of the Physical Development of a Population," F. Prinzing gives us a clear account of the whole question, and of the conclusions which we should draw. In his opinion the lower figures of the fitness of the rural-born population are due not to constitutional defects but to slower development, and he thinks that a successful enquiry into the matter can only be brought about if the causes of unfitness are thoroughly examined.

Great light would be thrown on the subject if it were possible to compare German recruiting statistics with those of other countries, but the laws and the regulations which govern such matters are so different in the various European countries that any sort of satisfactory comparison is impossible. But in any case it is interesting to have particulars of the state of affairs in other countries, and for this reason we are grateful to the well-known Austrian writer on military medical subjects, Paul Myrdacz, for the article which he published in 1907 in *Streffleurs Militärische Zeitschrift*, on "Medical Recruiting Statistics for Austria-Hungary from 1894 to 1905." This article is a continuation of two former ones, the first of which referred to such statistics for the years 1870 to 1882, and the second from 1883 to 1893. He shows that in Austria-Hungary, out of 1,000 men liable for military service the following proportions were:—

	1894-1905	1883-93
Accepted (as fit or more or less fit)	286	203
Not accepted on account of not coming up to standard..	29	110
		36
Not accepted on account of bodily infirmity	684	721

The two figures in the second column for "not up to standard" refer (1) to the years 1883 to 1888 (110) and to 1889-1893 (36).

In 1889 the standard of height was lowered to a minimum of 153 cm., and the age for military service was put back from 20 to 21. Myrdacz thinks that the present higher percentage of fit is partly attributable to these alterations.

With regard to detailed causes of unfitness, he gives us the following figures. In the period 1894 to 1905 as compared with 1883 to 1893 the following diseases have decreased:—

Tuberculosis (of the lungs and other organs)..	from	6·8	to	5·7 per cent.
Physical debility	,,	537·7	,,	430·2 ,,
Squint	,,	2·7	,,	2·5 ,,
Hyperidrosis of feet	,,	1·0	,,	0·4 ,,
Cicatrices	,,	7·0	,,	6·9 ,,

While the following have increased:—

Trachoma	from	2·7	to	4·3 per cent.
Epilepsy	,,	0·6	,,	0·7 ,,
Keratitis or corneal opacities	,,	4·7	,,	5·9 ,,
Myopia	,,	2·4	,,	2·8 ,,
Goitre	,,	25·1	,,	27·8 ,,
Defective teeth	,,	1·6	,,	3·5 ,,
Hernia	,,	19·0	,,	30·7 ,,
Bow-legs	,,	4·4	,,	4·6 ,,
Knock-knees	,,	21·1	,,	21·7 ,,
Flat feet	,,	11·2	,,	23·9 ,,

The author then gives a detailed account, illustrated by maps of the districts where these ailments are most common.

For many reasons, however, the figures for the Austro-Hungarian Empire cannot be compared with those of Germany, the statistics being obtained and made out in a completely different manner.

In France it is known that a complete transformation of military affairs has taken place since 1905, when the two years service system was introduced.

It is of interest to note some of the figures of French recruiting statistics for 1906 and to compare them as far as is possible with the German figures for the same year. On the lists of those liable for service there were 412,336 for France and 1,145,386 for Germany, that is to say, $2\frac{1}{8}$ as many again for Germany. This difference is so great that it shows the German figures to be over-estimated, although we cannot be certain that the French figures are absolutely correct. The number of men in the list for 1906 for Germany was 511,209 more than for France. If, however, we take the figures of those actually accepted for service, the number for France was 341,917, and for Germany 503,417; these were classed as follows:—

	In France	In Germany
Fit for military service	249,656 = 73 per cent.	230,008 = 45 per cent.
„ auxiliary service	28,131 = 8·2 „ (among these 3,158 for non-combatant service)	
Those who serve as one-year volunteers	30,271 = 8·8 „	55,408 = 10·9 „
Total of fit	308,058 = 90 per cent.	285,416 = 55·9 per cent

	In France	In Germany
Unfit	33,777 = 9·9 per cent.	33,327 = 6·5 per cent.
Exempt	82 = 0·02 „	921 = 0·18 „

With these numbers, however, the Reserve (Ersatz) is in the case of France exhausted, while Germany can count on the following:—

Ersatz Reserve	75,039 = 14·7 per cent.
Landsturm	116,032 = 22·7 „

It should be remarked that the French auxiliary service men do not correspond to the German non-combatant branch. The latter are only workmen or sick attendants, but in France the auxiliary service men do all the work that is not actual military duty, such as labourer's work, clerk's work, &c.

It is, however, loss of time to try and compare the figures, for the physical conditions for military service are quite different in the two countries. In France the standard height, for instance, is very low indeed, and again, men suffering from various diseases, regarded in Germany as causes of rejection, are permitted to enter the ranks; while such conditions as deafness of one ear, flat feet, club-foot, and loss of two fingers of a hand are allowed in the auxiliary service. This, therefore, explains the higher percentage of fitness for military service in France.

As regards recruiting statistics for Switzerland, the Swiss Government published their statistics from 1884 to 1891, but the figures for the following years were not made public till lately. The figures here given apply only to recruits who volunteer to go through their service immediately on reaching the age for service, that is to say, youths of 19. Of

100 who were examined and rejected, causes for rejection were as follows:—

	1886-90	1891-95	1896-1900	1901-05
Weakness, anæmia, convalescence from illness	4·1	4·6	4·2	3·3
Tuberculosis	0·30	0·36	0·52	0·61
Various respiratory diseases	0·21	0·26	0·31	0·27
Diseases of the heart and of the large blood-vessels	0·76	1·1	1·3	1·7
Diseases of the digestive organs	0·10	0·12	0·19	0·19
Malformations of the spine and thorax	0·80	0·68	0·75	0·86
Malformation or disease of the skull	0·09	0·10	0·09	0·10
Defective intellect	0·80	0·79	0·80	1·1
Mental diseases	0·07	0·07	0·07	0·06
Epilepsy	0·25	0·23	0·25	0·26
Various diseases of the nervous system	0·10	0·13	0·17	0·15
Goitre	7·1	6·0	5·7	6·1
Blindness of both eyes	0·05	0·02	0·02	0·02
Defective vision from myopia or errors of refraction	4·0	4·3	4·9	5·6
Other eye diseases	1·9	1·8	1·7	1·7
Deafness and dumbness	0·25	0·19	0·21	0·29
Weakness of hearing or other ear diseases	0·53	0·54	0·75	0·83
Stammering	0·16	0·13	0·13	0·17
Rheumatism and gout	0·06	0·08	0·08	0·10
Scrofula, rickets, &c.	0·56	0·53	0·49	0·44
Varicose veins and œdema of limbs	0·44	0·34	0·37	0·66
Hernia	2·8	2·8	2·6	2·7
Cirsoid aneuryism	0·22	0·12	0·06	0·09
Flat-feet	2·30	2·3	3·0	4·1
Injuries or fractures of upper limbs	0·8	0·73	0·71	0·73
Injuries or fractures of lower limbs	1·8	1·7	1·7	1·7
Totals	48·3	46·0	46·6	47·4

Men are included in these figures who are only unfit for the time being, but as they apply only to those in their 20th year, they give a fairly reliable idea of the diseases to which the Swiss youth are most liable, though it must be noted that incorrect conclusions might be drawn unless the extreme youth of those to whom the figures apply is taken into consideration.

The article concludes with a useful reference to fourteen different articles or works on the subject, all, with the exception of one Austrian, two French and two Swiss, being by German writers.

W. G. M.

The German Medical Service in Battle. (Supplement to *Deut. Mil. Zeitsch.*, August 5th, 1908, p. 36).—At the meeting of January 11th, 1908, of the Posen Military Medical Society, Herr Korsch said:—

"In spite of the state of perfection to which firearms have now been brought, it is curious to note that the number of losses in a battle have not changed in any appreciable degree, although the losses follow one another at closer intervals. The history of the Military Medical Service, the experiences of Schaefer, and the works of Bircher, Habart and Hoorns were all taken into consideration in the drawing up of the new medical regulations.

"The regimental dressing station is found to be absolutely essential, and the spot for its establishment will be determined by the direction of the evacuation of wounded. Suitable cover against modern firearms will only be found 1 to 2 killometres further behind the firing line than was recommended by Bircher in the war of 1870-1871. The necessity for

transport is exaggerated, as this can only be employed in intervals of firing and during advance movements.

"The medical arrangements for cavalry are now excellent, but the artillery is somewhat neglected. The small packages of surgical dressings have been used with excellent effect. Operations are seldom performed at the main dressing station, which serves more as a collecting station for wounded from the regimental dressing stations, for the searching of the battlefield, for the classification of wounded, and for the organising of the evacuation. Those cases which most require immediate and continuous treatment are sent to the field hospital. Like the Russian, the German Army has not good means for quick transportation from the fighting line to the field hospital, or to the line of rail. As it is now impossible to increase the number of wagons, assistance with the transport must be given by the field railways and motor vehicles. Time and place of the establishment of the main dressing station will be arranged by the medical and military authorities after consultation with one another.

"The prompt care of wounded can only be carried out by a well-organised and disciplined medical force. The greatest care and consideration should be given to the selection of its material; if we realise how to use it with care and economy the medical service will never be found wanting." W. G. M.

The Prevention of Sunstroke. (Heller, *Arch. Med. et Ph. mil.*, September, 1908, from *Militär. Wochenblatt*, No. 62, 1908.)—The causes of sunstroke may be divided into three groups: (1) Atmospheric influences; (2) military duties; (3) individual predisposition. These may be again subdivided as follows:—

(1) Atmospheric Influences.

(*a*) *Great Heat.*—Out of 258 cases of sunstroke, 208 (80·6 per cent.) occurred between 10 a.m. and 3 p.m., the hottest hours of the day. Regulations should permit of military manœuvres being finished by 10 a.m. in hot weather.

(*b*) *Humidity of Atmosphere.*—This reduces the amount of cooling effected by evaporation of perspiration. Thunderstorms and marching in close formation aggravate this. In wet thundery weather, therefore, it is advisable to have the ranks well spread out.

(*c*) *Stagnation of Air in Wooded Districts and in Valleys.*—If such routes cannot be avoided, the troops should be rested and allowed to get cool before marching through woods and valleys.

(2) Military Duties.

(*a*) In summer, marching hours should be between sunrise and 9 a.m., or between 3 p.m. and one hour after sundown.

(*b*) *Order of March.*—In very hot weather the ranks should not be closed up, and tunics buttoned, as is the custom in passing through villages.

(*c*) *Clothing.*—The regulations of 1900 allow the collar and the top button of the tunic to be unfastened and the tie removed.

(*d*) *The Load.*—The investigations of Zuntz and Schumburg show that a man cannot carry more than 22 kilogrammes (about 49 lb.) in great heat without danger. As the campaign knapsack weighs 27·6 kilogrammes (over 60 lb.), and presses on the shoulders and the thorax, regulations now prescribe that in hot weather knapsacks may be carried

in the general service wagons. As this means an increase of twelve to sixteen wagons per battalion, it can only be allowed in special circumstances.

(*e*) *Halts.*—Directly the officer in command observes that the men are suffering from the heat he should make frequent halts, about every hour, for fifteen minutes at a time, when the men can rest and undo their tunics, and perhaps have some food and drink. A spot should be chosen which is airy and shady, and where air is not intercepted by a wood.

(*f*) *Drink during the March.*—Brandy and all spirits should be absolutely forbidden. Pure water should be carried, or coffee or tea, in the water-bottle. If the men can be given cold water when passing through a village, this is a great boon in hot weather; but only light beer or mineral waters should be allowed to be purchased.

(*g*) *Food for the March should be properly Regulated.* — The men should have a good breakfast before they start, and should carry with them bread and butter or dripping, and sausage. Sugar should be given only occasionally, as the nourishment it affords does not last long. Marching requires a diet which repairs waste, and in which the proteids, fats and carbohydrates are given in proper proportions, as, for instance, a ration of bread and butter with sausage or cheese.

The cause of many cases of sunstroke should be sought in individual predisposition, as has been proved by the examination of 568 cases in the Prussian Army. This predisposition may be divided into two groups: (*a*) The influences of the habits of life and occupation, and (*b*) morbid condition of the pulmonary organs and the circulation.

(*a*) *Influences of Habits and Occupation.*—Out of 435 cases which have been observed, the following causes have been noted:—

(1) Reservists of the Landwehr, teachers ..	120 cases	= 27·6 per cent.
(2) Chronic drinkers	76 ,,	= 17·4 ,,
(3) Convalescents from disease	74 ,,	= 17 ,,
(4) Clerks (writers, &c.)..	49 ,,	= 11 ,,
(5) Corpulent men	47 ,,	= 10·8 ,,
(6) Military labourers	44 ,,	= 10·1 ,,
(7) Sick during period of incubation	40 ,,	= 9·2 ,,
(8) Insufficient sleep	28 ,,	= 6·4 ,,
(9) Recent imprisonment	18 ,,	= 4·8 ,,
(10) Insufficient nourishment	12 ,,	= 2·8 ,,
(11) Recent long leave (for harvest work) ..	9 ,,	= 2·1 ,,

All these causes help to weaken muscular resistance. The body requires three or four times more oxygen when a man is marching with a knapsack than it does in a state of repose, and therefore the respiratory organs require three or four times more energy. But when a man is ill or over-tired, or leads a sedentary life, these organs are not exercised and gradually the use of some of them is lost, and consequently the other respiratory muscles succumb rapidly under the weight of the knapsack.

In the same way more work is required of the heart at such times than it can do, except when a man is thoroughly healthy. When the heart is weak or injured by certain influences (such as alcohol) it fails, the pulse becomes weak and irregular, and cyanosis of the lips and ears, paleness of the skin, syncope, ensue.

It is the failure of the two great functions, breathing and circulation, which gives warning of the onset of sunstroke. There is only one way to avoid these accidents, and that is not to send on marches men who come under the above eleven headings, except after careful progressive preparation.

(*b*) *Morbid Conditions of the Pulmonary Organs and the Circulation.*—Certain morbid conditions may pass unperceived during daily life in the barracks which may yet become sources of danger to the action of heart and lungs when a man is marching and carrying a knapsack. Results of autopsies are as follows:—

(1)	Pleuritic adhesions	36 per cent.
(2)	Adhesions between liver and diaphragm	8·3 ,,
(3)	Cicatricial tissue at apices of lungs	8·3 ,,
(4)	Emphysema and chronic catarrh	8·3 ,,
(5)	Fatty hypertrophy of heart..	33·3 ,,
(6)	Lesions of endocardium and great vessels ..	5·5 ,,

In order to discover any such morbid conditions before the summer manœuvres a trial march should be made. This should be made in the neighbourhood of the barracks, the men carrying medium-weight knapsacks (15 kilos, about 33 lb.) and under the charge of the medical officer. Natural obstacles might be imitated by making the men go up two or three flights of stairs, and then their pulses, breathing, state of perspiration, and general condition should be examined. Those men who perspire at once abundantly, whose breathing is short and superficial, whose pulses are irregular and faces pale, who drag behind, or who become tired out by this trial march, will certainly be liable to get sunstroke. W. G. M.

Treatment of Hyperidrosis of Feet in the Army.—An article by Schminck and Schädel gives experience of treating hyperidrosis of the feet with ointments containing formalin, salicylic acid, boric acid, &c., and points out the value of using only fatty or acid substances that can be used as powders. A mixture of boric acid (30 parts) in spermaceti and "æthal" fats (2 parts) is found to be the best substance to use. It is sold under the name "Borsyl" and can be made into a fine powder. W. G. M.

Correspondence.

SODA BIBORATE IN EPILEPSY AND CHOREA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—For the past eighteen years I have used borax in the treatment of epilepsy made up in doses of 10 to 20 grains with 1 drachm of glycerine and 1 ounce of water for adults, in preference to all other drugs that I have tried, and with most beneficial results. I have never met with a case that has not been improved by it, and in a few instances it seemed to have entirely controlled the disease, as long as the cases remained under my observation. Owing to change of stations, it is naturally very difficult to follow up such cases, and the Regulations provide for invaliding of soldiers who are seen in a true epileptic fit.

I should like to know if other officers have tried this drug and with what results. I believe the majority use pot. bromid., pot. iodid, tr. hyoscyamus, soda brom., &c., which I have not found to be very effective.

Quite recently a healthy looking little girl, aged 5 years and 1 month,

was brought to me in a most jumpy condition, with marked choreic movements of upper and lower extremities, and leading its parents a dance both day and night owing to its silly behaviour. This child has been affected for the past three years and has been under the treatment of several medical officers at home and abroad. Various remedies appear to have been tried but without success. When I first saw the child on November 2nd, 1908, she was in a highly neurotic state and could not remain still for one moment. She had never been to school, and her father informed me she "jumped" in her sleep. I ordered sod. bibor., grains ii., glycerine ℥viii., aqua ʒii., three times daily. The dose of sod. bibor. was afterwards increased to 5 grains. Before three days expired her condition was quite altered and her parents became very sanguine as to her recovery. She has continued to make daily progress up to the present date. All nervous symptoms have disappeared, and she seems to be quite sensible and rational. Her parents have now decided to send her to school and she is allowed to play with the other children in barracks.

I hope to give this drug further trials in suitable nervous cases of a similar nature. The exact mode of its action cannot be explained, I can only speak of its efficacy.

I am, &c.,
M. O'Halloran,
Lieutenant-Colonel, R.A.M.C.

The Castle, Capetown,
January 12th, 1909.

DISPOSAL OF DUPLICATE COPIES OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—I would be obliged if you would kindly grant me space in your Journal to make the following announcement: "The Committee of the Sirhind Brigade Medical Library wish to dispose of the following volumes, duplicate copies of which are in the library:—

Bound Volumes.

Journal of the Royal Army Medical Corps, January—June, 1906.
" " " " July—December, 1906.
" " " " January—June, 1907.

Separate Numbers.

Journal of the Royal Army Medical Corps, January—June, 1907.
" " " " July—November, 1903.
" " " " January, 1904.
" " " " July, 1903.

I am, &c.,
Robert G. H. Tate,
Lieutenant, R.A.M.C.,
Secretary, Sirhind Brigade Medical Library.

Amballa,
January 12th, 1909.

YERSIN'S PLAGUE SERUM INOCULATION—A PERSONAL EXPERIENCE.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The account given by Lieutenant Wallace in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, July, 1908, of the curious and unpleasant indisposition of my companion in Bourbon, in April, 1907, naturally interested me considerably, and as it has seemed to most of the faculty I have consulted that it is most improbable that the extensive and intractable form of urticaria from which he suffered in October, 1907, and which persisted until January, 1908, could have any connection with the inoculation of Yersin plague serum on March 31st, 1907, I may, perhaps, give my further experiences which may throw some further light on the matter.

I had been free from neuritis and urticaria for more than a year (September, 1907) and flattered myself that I was at last free from further trouble; but a week or so after landing in Ceylon (October, 1908) I had a sharp attack of neuritis in the right shoulder and arm, which lasted for ten days. This about the tenth day was accompanied by a patch of urticaria on the right thigh, and the following morning a smaller patch about the size of a shilling appeared on the left thigh. The neuritis wore off in about a fortnight, but after a few days freedom I had a slight return with a considerable outbreak of urticaria on the thighs and legs.

Am I to conclude that the almost simultaneous attacks of neuritis and urticaria were merely fortuitous, or am I justified in assuming that both were due to the plague serum inoculation of March 31st, 1907? I would refer those interested in this matter to the account of my tour in Bourbon and its consequences, which I sent to the Journal in November, 1907.

I am, sir, &c.,

N. MANDERS,

Colombo. *Lieutenant-Colonel, R.A.M.C.*

ENTERIC INCIDENCE IN WEST AFRICA.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—I have only just read Captain Herrick's letter in your last issue on "Enteric Incidence in West Africa." I was on the Coast from 1893 to 1899; during that time I served in Sierra Leone and its Hinterland, the Gold Coast and its Hinterland, Lagos and its Hinterland, Nigeria, both in the delta and up country, under both peace and active service conditions. I never saw, knew, or heard of a case of enteric fever during that time. I did a tour of service in India before going to West Africa, during which I had charge of the Enteric Fever Wards at Bangalore, Madras, and Secunderabad, so that I think I ought to have been able to recognise a case of the disease had I come across one.

I hope that some other old "Coasters" with more service than mine on the Coast will write and confirm my experience.

I am, Sir, &c.,

February 19th, 1909. J. F. Burke,
Major, R.A.M.C., R.P.

ENTERIC CARRIERS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir, — In the current number of the Journal it is stated in the Editorial that "Up to the present a practicable method of treating the chronic carrier has not been devised."

With reference to this, I may say that some time ago I heard a most interesting paper read by Dr. T. Houston at a meeting of the Ulster Medical Association on a case of a typhoid carrier, where, after various treatments, including considerable doses of urotropine, had failed, the case was completely cured by three injections of antityphoid vaccine. The case has been fully reported in one of the last numbers of the *Lancet*,[1] but a most interesting sequel, which I have only heard from Dr. Houston to-day, is that two of the *cases which were infected* by the original carrier have now been discovered to be themselves carriers, and one of them is already yielding to vaccine treatment. It would be very interesting if Major Cochrane would try the vaccine treatment on his case if he has not already done so.

I suggested at the Ulster medical meeting that it would be justifiable to the patient and beneficial to the community to give each case of enteric fever a course of vaccine injections before pronouncing it free from infection, or, at anyrate, to do so where it was not possible to get a reliable bacteriological report, and in these cases a negative report cannot be absolutely reliable, as the bacilli may be hiding in the gall-bladder and only appear in the excretions intermittently, whereas the vaccine treatment would presumably clear them out of the entire system, *if* the vaccine was made from the right strain of typhoid bacilli, but in this, I think, lies the whole difficulty. In Dr. Houston's case, one carrier producing two others would lead one to think that there is a special breed of bacilli which produces "carriers." I should have mentioned that the vaccine used by Dr. Houston was made from the bacilli isolated from his patient.

It will be interesting to note in the future if any cases of typhoid treated by vaccines as recommended by Captain Smallman become typhoid carriers.

I am, &c.,

Belfast, G. J. Stoney Archer,
February 9th, 1909. *Captain, R.A.M.C.*

[1] We noted this interesting case, but as a short time has elapsed since the vaccine treatment, we think the cure is open to doubt. There is nothing novel in the vaccine treatment of "carriers." It has been carried on in London for some time, but up to the present a definite cure has not been reported.—[Editor.]

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Journal
of the
Royal Army Medical Corps.

Original Communications.

THE RESULTS OF SANITATION IN THE EFFICIENCY OF ARMIES IN PEACE AND WAR.[1]

BY SURGEON-GENERAL SIR ALFRED KEOGH, K.C.B., LL.D., M.D.

Director-General, Army Medical Service.

Being a Lecture delivered to the Royal Sanitary Institute, November 18th, 1908.

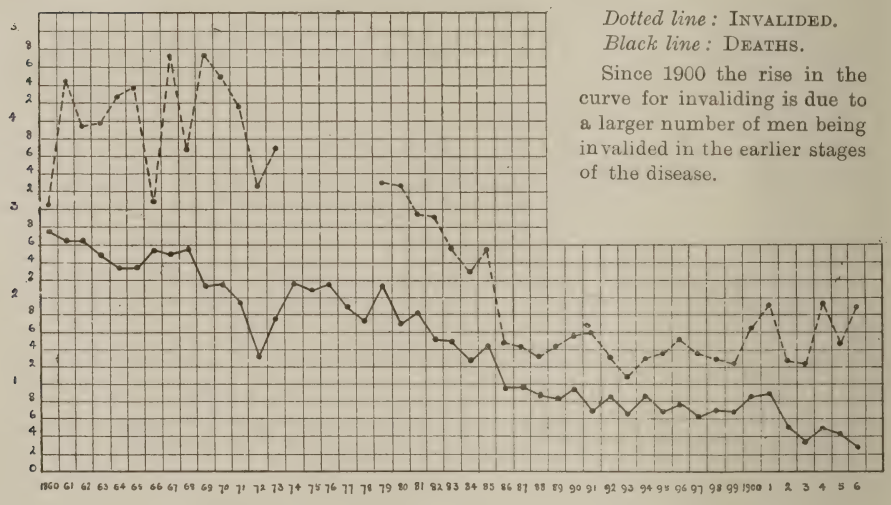
IT will be understood by the members of the Institute that, in venturing to address them on the "Results of Sanitation in the Efficiency of Armies in Peace and War," I do so by invitation of the Council. If I venture to accept so flattering an invitation, I do so not because I can hope to do justice to the subject, even if the time at my disposal were adequate. It is a subject which properly belongs to the philosophy of military history. It has never received sufficient attention, but there are not wanting indications that henceforth sanitation as an important factor in the maintenance of the fighting strength of an army in the field will receive definite recognition from military administrators and military commanders. I find an immense mass of material at my disposal, but I have resolved to limit myself to a few points which we may consider together with some profit to ourselves.

I wish to bring before you only certain cases of success that

[1] The statistics on which this paper is based were compiled by Lieutenant-Colonel C. H. Melville, R.A.M.C., Professor of Hygiene at the Royal Army Medical College, who is also responsible for the Charts and the notes on the same.

have crowned the work of the medical officers of the Army in past years, and before doing so I would like to say a few words as to the position of sanitation in the general scheme of army organisation. The Army leads a dual existence. At one time, like so many organic beings, it leads a purely quiescent life, that is peace; at another, it develops a virulent stage, and that is war. Now sanitation occupies a totally different position, according as the Army is quiescent or virulent. In the former state, in peace time, the measures of sanitation which we recommend are limited only by their cost. I may say that it is my experience, and I think that of most officers, that if a sanitary officer can make out a good case for

CHART I.—TUBERCULOSIS AT HOME AND ABROAD.
Ratios per 1,000 *of Strength.*



Dotted line: INVALIDED.
Black line: DEATHS.

Since 1900 the rise in the curve for invaliding is due to a larger number of men being invalided in the earlier stages of the disease.

any project of a sanitary nature, and the money is available to carry it out, he will not find that any difficulties will be put in his way, on purely military grounds. In war everything is different. To use an Americanism, "The army does not go to war for its health." In war, everything, sanitation included, must be subordinated to that leading principle of strategy, getting the greatest possible number of fighting men to the decisive point in the shortest time. If sanitation can help on this object, then no one will welcome it more than the commander, whose reputation depends on his fulfilling the above strategical problem. But the sanitary officer who expects a commander to delay his advance, with the sole object of

saving life from preventable disease, without in any way forwarding his main strategical object, more than deserves the want of recognition that he will undoubtedly receive. Of course, if there is time in hand, a delay of a few days may enable the force that reaches the decisive point to be larger; the problem is not entirely one of time, it is also one of numbers. But the same great commander who said, "Heaven is on the side of the big battalions," also said, "Ask me for anything but time." You will be able to judge from the above the nature of the proofs of previous and probable success that the sanitary officer has to bring forward when submitting any scheme to his commander-in-chief. He must show in peace time that he will save more money than his scheme will cost, in war time that his measures will not only not delay the army, but that they will enable the commander to stand on the decisive spot with a larger number of men than he could in the neglect of those measures expect to have, and in either case his position and his arguments will be very much strengthened if he can show that on previous occasions other measures recommended by him, or similar measures recommended by others, have had the success that he now hopes to achieve.

As instances where sanitary measures have increased the efficiency of the army in peace, I will take four specific diseases in four different quarters of the globe: (1) Tubercular disease in the Army serving at home and abroad; (2) cholera in India; (3) enteric fever in India; and (4) mediterranean fever in Malta.

Chart I. shows the yearly fluctuations in the invaliding and death-rates from tubercular diseases for the entire British Army, at home and abroad, since 1860 inclusive.

Unfortunately, the invaliding rates for the years 1874 to 1878 inclusive cannot be shown, as during these years our reports class tubercular diseases under enthetic diseases, and do not furnish separate figures. Taking the death-rate first, it will be seen that there has been a steady fall in the ratio of deaths during the period under review, broken by only two important rises. The first occurs in the years 1872 and 1873, and its effect is seen to last till well into the early eighties. The second rise occurs during the years 1900 and 1901, the years of the South African War, to which campaign it is undoubtedly attributable. The cause of the first and most important rise is difficult to estimate. Probably there was more than one cause at work, but the reports of the Army Medical Department give no information as to what these may have been.

The curve representing the variations of the invaliding ratio is much less regular than that representing those of the death-rate. The curve, as a whole, shows a marked fall, but this began much later than the fall in the death-rate. Owing to the gap in the statistics during the years 1874 to 1878, already alluded to, it is hard to say whether the fall commenced in 1872 or later. Once the fall began it was, however, very rapid, and lasted till 1893, since when, though with considerable oscillations, the curve has had a slightly upward tendency. This rise is probably due to the recognition of the potentially infective nature of all phthisical cases. The oscillations are less easy to explain. The rise in 1900 and 1901 may be attributed to the war, but those of 1904 and 1906 cannot thus be accounted for. Invaliding being the result, not of an operation of nature, but of the opinion held by officers of the Medical Corps as to the effect of a disease on a man's fitness for the ranks, naturally fluctuates with the fluctuation of ideas on this point. However, apart from these fluctuations, the enormous decrease in the total wastage of the Army from tuberculous diseases is unmistakable. In the year 1860, with an army of under 200,000, we lost by death and invaliding 1,143 men; in the year 1906, with an army 230,000 strong, we lost only 590 men; a reduction of nearly 60 per cent. Coincident with this decrease in the wastage due to tubercular disease in the Army, we have a decrease in the prevalence of the same disease in the civil population. But the decrease in the military population has been greater than that in the civil population at the same ages. Taking the Army serving in the United Kingdom only (and obviously it would be unfair to compare the civil population of this country with the troops serving abroad), we find that the death-rate of the civil population at the military age has fallen since 1860 by 50 per cent., while that of the Army has fallen 90 per cent. To this latter must, however, be added the loss due to invaliding; and if we take it that half the men invalided for tuberculous disease would otherwise have died within their period of colour service (a rather liberal assumption), and add this amount to the death-rate, we find that the total loss from these diseases has fallen by 80 per cent. The difference in the amount of decrease between the civil population and the Army may therefore be fairly credited to changes in the soldier's life and surroundings during the above period.

Now the greatest change that has occurred in the daily life of the soldier in the past fifty years has undoubtedly been in the direction of better housing. What his surroundings were at the

beginning of that period may be judged from the report of a Royal Commission, appointed in the 1857 to investigate the condition of barracks and hospitals in the United Kingdom. I will not trouble you with extracts from that report. Suffice it to say that about a quarter of the Army at home lived in rooms affording them less than 350 cubic feet per man, while only about 6 per cent. of the whole force were provided with more than 550 cubic feet of air space per man. Since the sitting of that Commission, and as a result of its report, the housing of the soldier has gradually been improved. Old barracks have been altered and new ones built on improved plans, and *pari passu* with these changes and improvements the wastage from tuberculous disease has lessened till it stands at the present figure. I think I may therefore, in respect of this class of disease, place to the credit of sanitation the increased efficiency that has resulted from the presence in the ranks of the Army to-day of the men who, under the conditions that prevailed fifty years ago, would have been dying in hospital or invalided to civil life.

The second illustration which I shall take to elucidate the subject of my paper is that of cholera in India. This disease, within the recollection of many of us still serving, used to be a constant and most unwelcome visitor at all our up-country stations.

Charts II. and III. show in graphic form the admissions and deaths per 1,000 of strength for this disease for the entire European Army in India from the year 1860 till the year 1907.

The first feature that strikes one in looking at these curves is the enormous fluctuations to which they are subject in the '60's and '70's. In the former decade especially the Army seems to have been liable at any moment to the most devastating attacks of cholera. Thus in 1861 there were over 1,500 admissions and nearly 1,000 deaths from this disease. The terrible nature of this outbreak may be better demonstrated by saying that the army of India in 1869 lost from cholera alone nearly three times as heavily as it lost in 1906 from all causes combined. Heavy as this visitation was when we take the whole Army, its severity becomes even more terrifying when we consider the fate of individual units. In the year under consideration the 27th Foot at Morar lost one-sixth, the 51st at Meean Meer one-quarter, and the 94th at the same station one-third of its effective strength. And this mortality was not spread over the whole year. A few weeks at the outside covered the whole of these awful tragedies.

Little wonder that in the face of these appalling calamities, so

inexplicable in their origin, so mysterious in their progress, and so erratic in their incidence, men of the clearest intellects seem to have lost their powers of weighing evidences or of logical deduction. The literature of cholera in the days before the advent of Koch

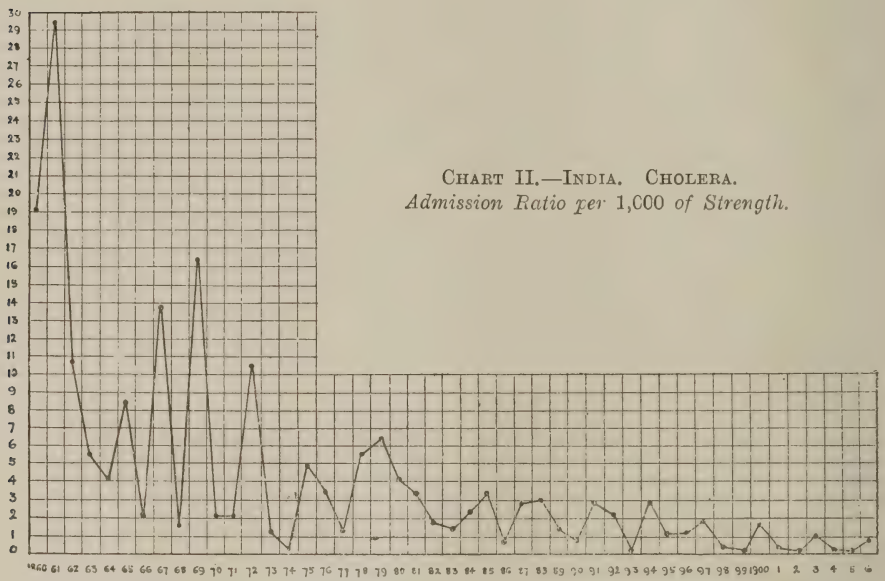


CHART II.—INDIA. CHOLERA.
Admission Ratio per 1,000 *of Strength.*

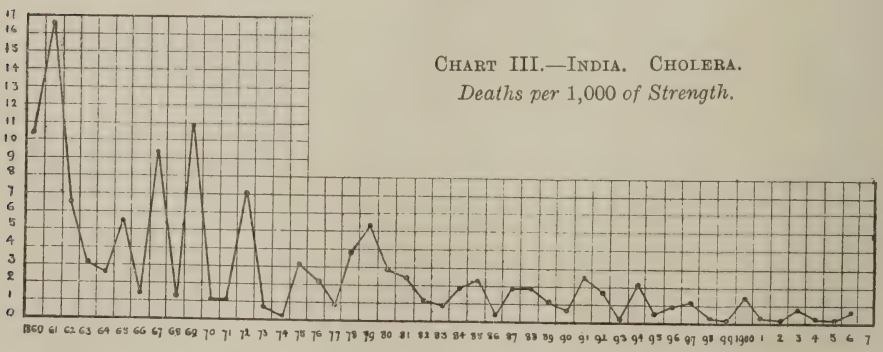


CHART III.—INDIA. CHOLERA.
Deaths per 1,000 *of Strength.*

teems with the most wonderful theories, all ingenious, and all as futile as the private soldiers' well-known tale that the disease followed the path of the wandering Jew. Theories of miasm, of telluric waves, of epidemic constitution, followed one another in endless succession, and it was not till the discovery by Koch in the year

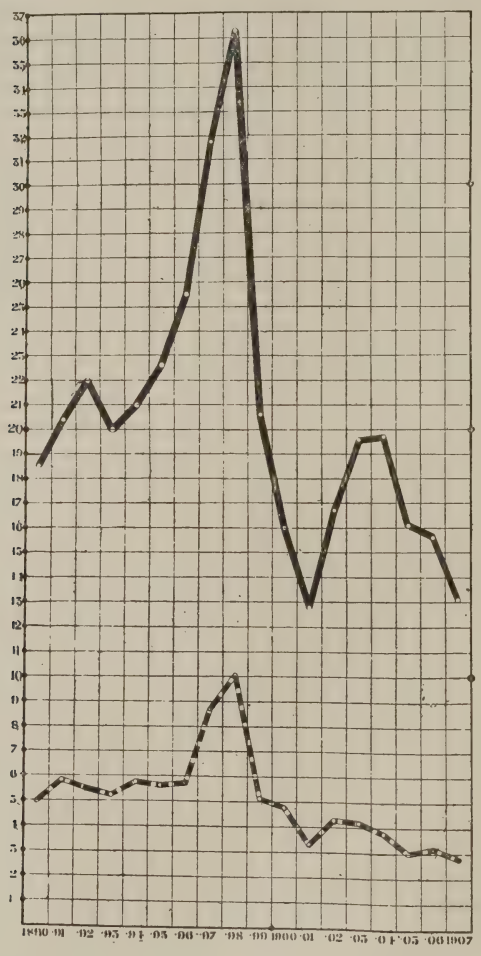
1884 of the vibrio of cholera that any logically grounded method of prevention could be adopted. True, before that time attention had been paid to the quality of the drinking water, not so much as being a cause, or rather the vehicle of the cause, of specific disease, but as influencing indirectly general health and well-being. This attention undoubtedly did good, and to it may be attributed the diminished incidence of cholera in the '80's and early '90's. It was not, however, till 1894 that a severe outbreak of this disease at Lucknow, which was clearly and scientifically traced to the use of contaminated sand in the filters of the corps attacked, demonstrated to everyone far and wide that water, and water alone, was the vehicle by which the vibrio of Koch was admitted to the human body. Sporadic outbreaks still no doubt occur, and living as the Army has to do, an oasis of cleanliness in a desert of filth, it cannot hope to escape such occasional blows; but anything in the nature of the catastrophes of the '80's, or the periodical visitations of the '70's and '80's, is now out of all practical calculation, and that this is so is due to the recognition of the hygienic principle that water is the vehicle of the cause of cholera, and to the application of that principle to the exigencies of the soldier's life.

We now come to my third illustration, enteric fever in India. The curve (Chart IV.) shows the admission-rate for this disease in the Army of India since the year 1890.

Now at first sight this chart does not seem very illuminating, nor in fact to do much credit to the efforts of the sanitary officers of the Army of India. Here we can show no such creditable reduction as in the case of cholera. And this point is of great interest. Here we have two diseases caused by germs, neither of them provided with spores, and therefore apparently not differing materially in their powers of resistance to external influences, both evacuated from the human body by means of the intestinal discharges, both entering the human body by the mouth, and yet the measures which have proved so efficacious in the case of the one have proved not only inefficacious in the case of the other, but have seemed almost to have favoured the spread of the disease. At more than one station the introduction of a pure water supply has been followed by an increased prevalence of enteric fever. Quetta, that important station on our Beluchistan frontier, is a very good instance. Now of course I do not for one moment wish you to suppose that I hold the heresy above suggested. I only point out this fact—for a fact it undoubtedly is—to show how careful one must

CHART IV.—INDIA. ENTERIC FEVER.

Admissions and Deaths. Ratios per 1,000 *of Strength.*



The rise between 1890 and 1898 is generally attributable to cumulative infection of the latrines, &c., by the dry-earth system of removal. The fall in 1899 is partly attributable to the presence of a large number of protected men consequent on the high incidence of fever during 1898. This was assisted by the fact that after the outbreak of the South African War in October, 1899, drafts of young soldiers no longer came out to India, the Army in that country becoming steadily older and less susceptible to this disease. It is to be noted, too, that in 1898 the sanitation of the Army, which had up to that date been in the hands of the Quartermaster-General's Department, was brought under the Principal Medical Officer of Her Majesty's Forces in India. In addition, in 1898, a sanitary officer was specially appointed to Army Headquarters, the first holder of the appointment being Major A. M. Davies, R.A.M.C., and in 1900 and 1901 sanitary officers were posted to the headquarters of the four commands, Punjab, Bengal, Madras, and Bombay. The low rate of incidence continued throughout the South African War, and the rise in 1902 is attributable to the re-opening of reliefs consequent on the termination of that war. The fall since 1904 is attributable to the recognition of the dangers of latrine infection, and the measures taken to combat the prevalence of flies. Some credit must, however, be given to the administrative changes alluded to above, which introduced a scientifically organised system of sanitation throughout India.

be in arguing that measures successful with one disease are necessarily successful with another, however similar the two diseases may seem to be in their mode of origin. It was not till about the year 1898 that attention became diverted, in the case of enteric fever, from drinking water as a cause of this disease to methods of conservancy. I will not trouble you with a detailed description of the conservancy methods in use in cantonments in India; suffice it to say that they consist in pail and cart removal system combined with the use of dry earth as a deodorant, the details of the system on which its success entirely rests being left to depend on the personal care and attention of the two most careless individuals on earth, the uninstructed British private and the native sweeper. The opportunities afforded by the carelessness of men were boldly seized upon by the all-pervading fly. By the energy of this enterprising insect, filth was rapidly and unostentatiously conveyed from the latrine to the dining-room, and any existing focus of infection given every opportunity of widening its area. In the past two or three years particular attention has been paid to the agency of infected latrines and flies as causes of enteric fever, and it is to this attention that, in the opinion of the majority of sanitary officers having practical experience of enteric fever in India, the diminution in this disease during the last few years has been due. During the last few years, it is true, we have learnt much more than we knew previously of the influence exerted by the so-called "bacillus carriers," and our attention is now directed to these men, and to all men who have lately come through an attack of the disease. But the latrine as the source, and the fly as a potent means of dissemination of the poison existing there, will always attract the chief attention of the practical sanitarian. I do not propose to do more than refer in passing to the effects of inoculation for enteric fever, but I may say that the latest results show that the incidence of the disease can be reduced 60 per cent. by this means, while at the same time the inoculated man has, if attacked, twice as good a chance of recovery as the uninoculated man, and we confidently look forward to even better results in the future.

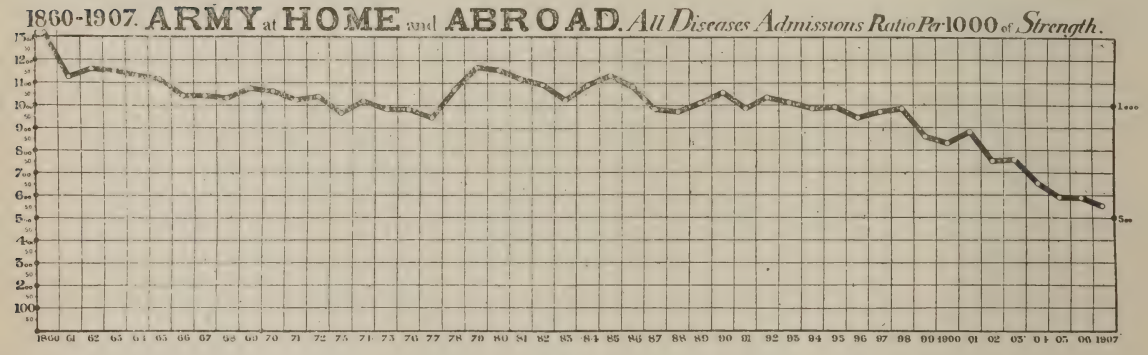
It has taken us many years to arrive at any safe conclusions as to the causation and prevention of enteric fever in India, but I think, and my opinion is shared by those most conversant with the situation, that we have now begun, if I may use the expression, to feel our feet in this difficulty, and hope that before long, in the case of this disease as in that of cholera, we may be able to look on enteric fever as merely an occasional visitor, and not as a persistent and most unwelcome guest.

My fourth and last illustration is that of Mediterranean fever in Malta.

The facts in the case of this disease are so extraordinary, and the history of its prevalence has so dramatic a *dénouement*, that the simplest statement is alone adequate to its recital. I will not trouble you with curves, or columns of figures. In the year 1904 there were 320 cases of Mediterranean fever in the garrison of Malta; in the year 1905, 643; in the year 1906, 161; in the year 1907, 11 cases; and up to to-day, in the year 1908, 2.

This extraordinary change dates from the discovery that the Maltese goat acted as a constant host to the *Micrococcus melitensis*

CHART V.



The rise in the admission-rate, beginning in 1877 and lasting until 1892, was probably attributable to the introduction of the Short Service System, and the Departmental Medical System at about the same time.

and excreted that germ in its urine, and even more importantly in its milk. The use of goat's milk was prohibited in barracks in June, 1906, and simultaneously with that order Malta fever ceased to exist as far as the military garrison of Malta was concerned. (The majority of the 161 cases of this disease that I have mentioned above as occurring in the year 1906 were admitted before this administrative measure was adopted.) The whole history of sanitation in our Army shows no climax so striking, no other preventive measure so surely based on experimental observation, and so supremely successful when put into execution.

I have now given you three instances wherein purely sanitary measures, the provision of better air in tuberculosis, of better water in cholera, and of better milk in Malta fever, have directly increased the efficiency of the Army by keeping its ranks full.

In the case of the fourth disease, enteric fever, I have shown that we may confidently hope that by improved methods of conservancy we may in this case also attain our object. The case cannot yet, however, be considered complete.

The natural man has an inborn dread and distrust of statistics. He knows well, each man in his own work, how difficult it is to judge from tables alone, and how very misleading may be the deductions that can be drawn from an imposing array of figures. More especially is this the case when these figures apply to a science with the working of which he is himself unacquainted, and this feeling is intensified when that science is not studied as a whole, but parts only are taken for examination. So far I have given you the effects of sanitation as shown in the case of four diseases or groups of disease, and it would be open to anyone to say that I have chosen my facts to fit in with my theories, and so to prove my case. The only practical tests of the health of an army are two: Firstly, how many men are absent from duty on account of sickness? and secondly, how many men are lost to the Army every year by deaths and invaliding?

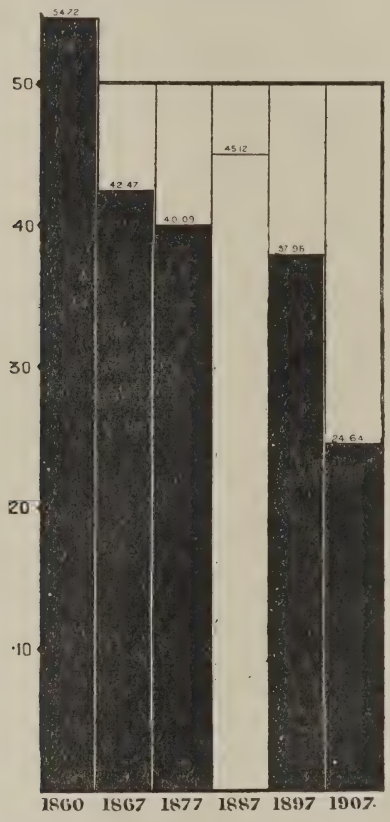
If in the course of a number of years we find that progressively fewer men are absent from duty on account of sickness, and fewer men lost year by year from the ranks by death and invaliding, then we can only refer these changes to the dissemination of a knowledge of those natural laws which collectively form the science of hygiene, and that application of those laws to the circumstances known as environment, which we call sanitation.

As regards the first, the curve, Chart V., shows the number of men admitted to hospital per 1,000, that is, the number admitted from a battalion of infantry at full strength, year by year since 1860; and the diagram, Chart VI., shows the number of men constantly absent from their duty in every battalion in the United Kingdom on account of sickness in the years 1860, 1867, 1877, 1887, 1897, and 1907.

As regards the curve showing admissions, you will notice that the fall, though not continuous, has been on the whole fairly steady, and of late years very rapid. Thus in the year 1860 every man in the Army was admitted once to hospital in the year, and every third man twice. By 1875 the admissions had fallen so that only one admission was recorded per man. For seventeen years from that date affairs were not so prosperous, and it is not till 1892 that the number of admissions was again so low as it had been in 1875. What the causes of this rise were it is hard to say; the

change from long service to short, the substitution of the departmental medical system for the old regimental system (a change which, like all changes, however advisable, and however beneficial in the long run, was bound to affect to a certain extent unfavourably the relations of the doctor to the soldier, more especially where

CHART VI.—ARMY AT HOME. NUMBERS CONSTANTLY SICK.
Ratio per 1,000.



The thick line at the "50 per 1,000" level indicates the theoretical strength of a half-company in a battalion.

the supervision of the soldier's life was concerned), and probably other causes also, may have combined to increase the sick-rate of the Army. However this may be, the fifteen years since 1892 form a marked contrast to those preceding that date. From one admission to every man in 1892 we have fallen to very little over half that number in 1907.

Let us turn to the numbers constantly sick; the numbers, that is, absent from military training every day owing to their being in hospital. In the diagram, Chart VI., you will see represented the number of men absent every day from duty in a battalion of infantry at full strength in the United Kingdom in the years 1860, 1867, 1877, 1887, 1897, and 1907. I have confined myself to the figures of the United Kingdom, since I have been unable to obtain those for the whole Army for the earlier years. The thick black horizontal line represents the strength of a half-company in our theoretical battalion, and you will see, whereas in 1860 more than a full half-company was missing from parade, in 1907 only one-half of that body were absent and in hospital.

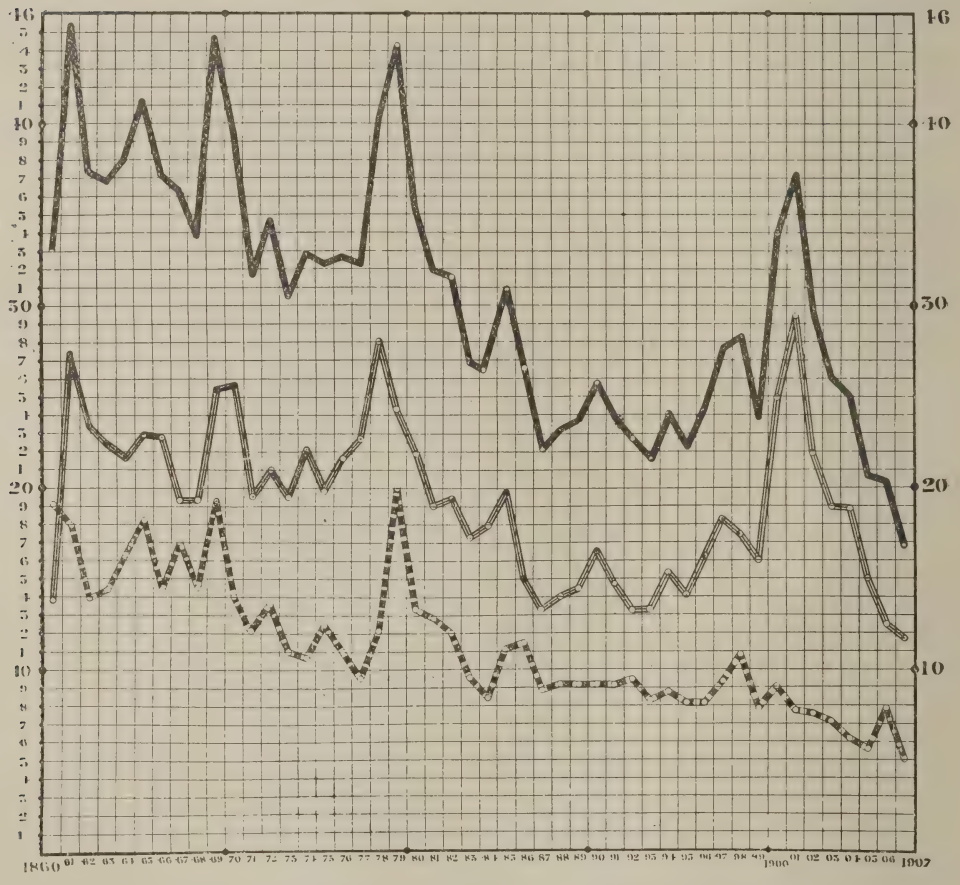
Now a man in hospital in the Army is not in the same position as a man in civil life. The latter loses all his wages, the former still draws his pay, not in full, since a certain amount is deducted for hospital stoppages, but he still draws from the State the sum on a average of 9d. a day while doing no work. Thus every man constantly sick for a year costs the State in pay only—I am not considering other charges—nearly £14 per annum. In 1860 there were 5,346 men constantly sick at home, in 1907 there were 2,655. This difference of 2,691 men less in hospital represents a saving of £37,674 from this cause alone. The loss of money due to pay unearned is, of course, not the only loss incurred by the State on account of each man in hospital. Not only is the man not doing his work, he is forgetting his work. But I will not labour this point. There is an old saying that "money talks," and 37,000 odd golden sovereigns talk, I think you will agree with me, fairly loudly.

Let us now turn to the question of total loss to the service from death and invaliding.

The curves, Chart VII., show the variations in these since 1860. The lowest line shows the deaths, the second the invaliding, and the highest line these two ratios added together. It is to this line that I would especially direct your attention. The two forms of loss cannot in fact be dissociated; a fall in the death-rate may be explained by a rise in the invaliding rate; but a fall in both rates together can only be explained in one way, and that is by improved health. Here again the fall, though not continuous, has been steady, far steadier than that shown by the admission-rates. You will at once see that the period of high admissions between 1887 and 1892 (see Chart V.) is not reproduced in these curves, a fact which goes to show that those high admission-rates were due

not so much to causes seriously affecting the health of the Army as to the factors connected with its interior economy. The years of the Afghan and South African Wars, 1878-79-80, show high

CHART VII.—ARMY AT HOME AND ABROAD. ALL DISEASES.
Ratio per 1,000 *of Strength.*



Broken line: DIED. *Shaded line:* INVALIDED. *Black line:* TOTAL LOSS.

1861.—Severe outbreak of Cholera in India.
1865.—Cholera in India, New Zealand, and Bhootan Campaigns.
1869.—Severe outbreak of Cholera in India.
1878-80.—Wars in Afghanistan and South Africa.
1885.—Nile Expedition.
1897.—Tirah Campaign.
1899-1902.—South African Campaign.

rates, but eliminate these and you will see that till the late '90's the fall was continuously maintained. The years 1897 and 1898 were those of Omdurman and the Tirah Campaign in India, and

were also marked by a high incidence of enteric fever in the latter country. 1899, 1900, and 1901 were the years of the South African War, and though these curves do not show deaths actually occurring in the field, the effect of that campaign on invaliding is, as you will see, strongly marked. Since the war the old progressive decrease has recommenced and continued uninterruptedly.

There is only one explanation possible of this continuous decrease in the loss to the Army by death and invaliding, accompanied as it has been by a continually diminishing number of men admitted to and remaining in hospital, and that explanation is improved health, the result of improved sanitation.

So much for times of peace. We now turn to war. Here, as I have already told you, the object of the sanitarian must be to assist the commander in his desire to place the largest number of effective men at the desired spot in the shortest time. The sanitary officer cannot influence the selection of the spot; that is decided by considerations obviously outside his purview and control, often indeed outside those of the commander himself. He cannot influence the time, except to lengthen it, but he can affect the number and efficiency of the men that can be present at that place and time. And it is to this that he must direct his undivided attention, always keeping in mind that the one unpardonable sin is delay. It is because sanitary officers have so often lost sight of this fact that generals have so often lost sight of them.

Now it may at once be conceded that it is to all intents and purposes hopeless to expect a force in the field to remain as healthy as a force in cantonments. The inevitable physical and mental stress, the fatigues of marching, insufficient and irregular meals, scanty and often bad water, and all the other thousand and one breaches of the rules of personal hygiene that are inseparable from campaigning, must inevitably tend to lower the general health and the resisting power of the men. A certain amount of disease is therefore inevitable. It may be said that this is begging the question. Why should meals be scanty and irregular, water bad and insufficient? Cannot organisation avoid these evils, and so save the soldier from these causes of preventable disease? Certainly organisation can, given time to work; but this is just what it often cannot have, and cannot expect to have. It was said, I forget now by whom, at the time of the South African War, that it would have been possible by precautions of a proper nature to have avoided the severe outbreak of enteric fever that occurred at Bloemfontein, in the early days of the occupation of that town; but that if these

precautions had been rigorously enforced the troops would never have got to Bloemfontein at all. Without entering into the merits of that particular statement, there is a good deal of truth in the argument that it contains. Let me repeat that an army does not go to war to preserve its health, but to defeat an enemy. Any precaution that does not assist it to do so, far more any precaution that hampers it in doing so, is a dereliction of duty on the part of the sanitary officer who recommends it, and of the commanding officer who carries it out. Having said so much is not, however, to say that nothing can be done. Much can be done, and more will be done and more efficiently done, if the above truth be kept always in mind, than if it be forgotten.

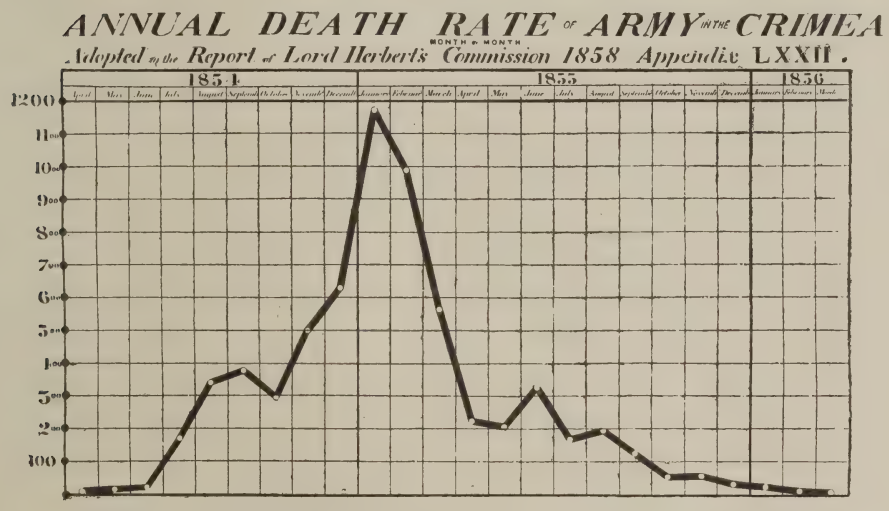
Of what can be effected I will adduce three examples. The first, is that of two campaigns waged at different times against the same enemy and in the same country, the only difference between the two being that on the first occasion the rules of health were disregarded, and in the second observed. My second example will be that of a campaign in which the troops occupied continuously for nineteen months the same position, but were neglected in the earlier months and carefully looked after in the later ones. My third will be that of a regiment which, in the dark days of sanitation, by a careful attention to its internal economy, as sanitation was understood in the eighteenth century, was successful in maintaining a standard of health unknown in the rest of the Army then and never surpassed since.

My first example is that of the Ashanti campaigns of 1854 and 1873, waged in the same country, against the same enemy, the latter of which was entirely successful, the former an absolute failure, the decisive factor being not the opposition offered, or the weapons carried by a feeble and despicable enemy, but the fact that in one case the rules of hygiene were known and observed, and that in the other they were probably not known and certainly ignored. In the campaign of 1854 the entire force melted away, all the men that did not die being invalided. In the campaign of 1873 the death-rate was 1·7 per 1,000. Similar examples might be given from the Walcheren campaigns, compared with other campaigns in the Low Countries; and the Russian invasion of Turkey in 1826, compared with that of 1878. Instances might be multiplied almost indefinitely to prove that the absence of sanitation has in one instance wrecked an army, when other armies, composed of the same troops, fighting against the same enemy, on the same ground,

have carried their campaigns to a successful conclusion by attending to this important condition.

My second example is taken from the Crimean campaign. Throughout the greater part of this campaign the British troops were encamped on the heights above Sebastopol. What the sufferings of the men were in that campaign is well known from the writings of the *Times* correspondent, Dr. Russell. The diagram, Chart VIII., shows the annual mortality per month in that Army from April, 1854, to March, 1856.

CHART VIII.



Crimea invaded, September 14th, 1854.
First bombardment of Sebastopol, October 12th, 1854.
Battle of Inkerman, November 5th, 1854.
Severe hurricane and loss of many stores, followed by snow and continuous bad weather, November 14th, 1854.
Assault on Redan, June 18th, 1855.
Fall of Sebastopol, September 28th, 1855.

The Crimea was invaded on September 14th, 1854, and the first bombardment of Sebastopol took place on October 12th of the same year. The campaign was virtually at an end by February, 1856. The mortality of the troops during the first winter is terrible to contemplate. In January, 1855, the annual rate of mortality was higher than that of London during the worst part of the Great Plague of 1665. In January, 1856, the mortality had fallen to 23 per 1,000 per annum. During the twenty-two weeks ending

May 31st of that year the mortality of the army before Sebastopol was only two-thirds of that of the troops at home during the same period. In the words of Lord Herbert's Commission, "Perhaps no army was ever better cared for, or more sanitary precautions taken in its behalf as regards drainage, both surface and subsoil, cleanliness, ventilation of huts, diet, clothing, &c., than the army before Sebastopol" during the period mentioned. Now there is not the slightest doubt that, given ordinary forethought, the troops might have been as well hutted in the winter of 1855 as in that of 1856, The distance from the seaport of Balaclava was only a few miles. and the line of communications was safe. The progress of the siege would not have been in any way interfered with if the men had been comfortably housed; there were no countervailing military objections to interfere with sanitation. The situation was pre-eminently one where the sanitarian might have been given a free hand, not only without interfering with the operations of war, but with the result of considerably furthering them.

I now come to my third example. The word "efficiency" is the keynote of this paper, and before concluding I would like to relate a very conspicuous instance of a regiment in which the very highest military efficiency went hand-in-hand with the very highest degree of health. The 7th Dragoon Guards, then known as the Black Horse, served in Flanders in the years 1742 to 1747. During this period it is related of this regiment that it never lost a man by desertion, never had an officer or man tried by general court-martial, never had a horse or man taken by the enemy; that it lost but six men by sickness, and had no fewer than thirty-seven of its non-commissioned officers and men promoted to commissions for distinguished conduct.

The efficiency of this regiment and the health of its men were attributed unanimously, by all who were in a position to judge, to the attention to the interior economy and welfare of the corps (that is, to sanitation) paid by its colonel, Sir John Ligonier. This officer had the highest reputation as a fighting soldier, and also as a strategist. The battles of Malplaquet, Dettingen and Fontenoy, in all of which he distinguished himself by personal gallantry, bear testimony to the former quality, while the latest historian of the Seven Years' War awards him the highest praise in the latter capacity. It is related of him that such was his anxiety for the welfare of his men that he maintained an additional medical officer in his regiment at his own cost. I have quoted this instance of Sir John Ligonier because one so often hears it said that attending

to the health of the soldier is mollycoddling him. The battles of Dettingen and Fontenoy were no child's play, and Sir John Ligonier was no featherbed soldier, while the discipline demanded of the British soldier in the middle of the eighteenth century was as far removed from mollycoddling as any condition of life could well be. Yet in this regiment, which distinguished itself above all others in that campaign in Flanders, under a commanding officer of whom Marshal Saxe said, "By one glorious action he has disconcerted all my projects," surrounded by other regiments suffering severely from the usual diseases of campaigns in those days, scurvy, fevers and dysentery, only six men died of disease in five years. I think that this incident of military history is as brilliant an illustration as can be given of the connection of sanitation with efficiency in war.

REPORT ON INVESTIGATIONS CARRIED OUT IN THE BAHR-EL-GHAZAL PROVINCE ON BEHALF OF THE SUDAN SLEEPING SICKNESS COMMISSION, 1907-1908.

By Captain H. ENSOR, D.S.O.

Royal Army Medical Corps.

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(3) Areas of distribution of *Glossina morsitans.*
(4) Habits, &c., of *G. palpalis.*
(5) Habits, &c., of *G. morsitans.*
(6) Variation in numbers of *G. palpalis* during the wet and the dry seasons of the year.
(7) Food supply of *G. palpalis.*
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(1) The Tsetse-flies of the Bahr-el-Ghazal Province.

The tsetse-flies in the Bahr-el-Ghazal appear to consist of only two species of the genus *Glossina;* these are *G. palpalis* and *G. morsitans.*

No other tsetse-flies have come to my notice, and, as many hundreds have been captured and examined during the last eleven months without the discovery of any species other than the two mentioned above, it may perhaps be accepted with some degree of confidence that no other species of *Glossina* exist in this part of Africa.

(2) Areas of Distribution of Glossina Palpalis.

G. palpalis. Arabic: "*Diban el Marad en Noom,*" "The Fly of Sleeping Sickness." Zandeh,[1] "N'gunga."

This fly has on three occasions, and by three observers, been previously reported as existing in the Bahr-el-Ghazal Province, having been first reported at M'volo by Major Bray, R.A.M.C.,

[1] Zandeh is the name of a large tribe inhabiting the Congo Free State and Sudan frontier regions.

in 1905, and again by Major Dansey-Browning, R.A.M.C., and myself, at Zungumbia and Wau respectively, in the year 1906.

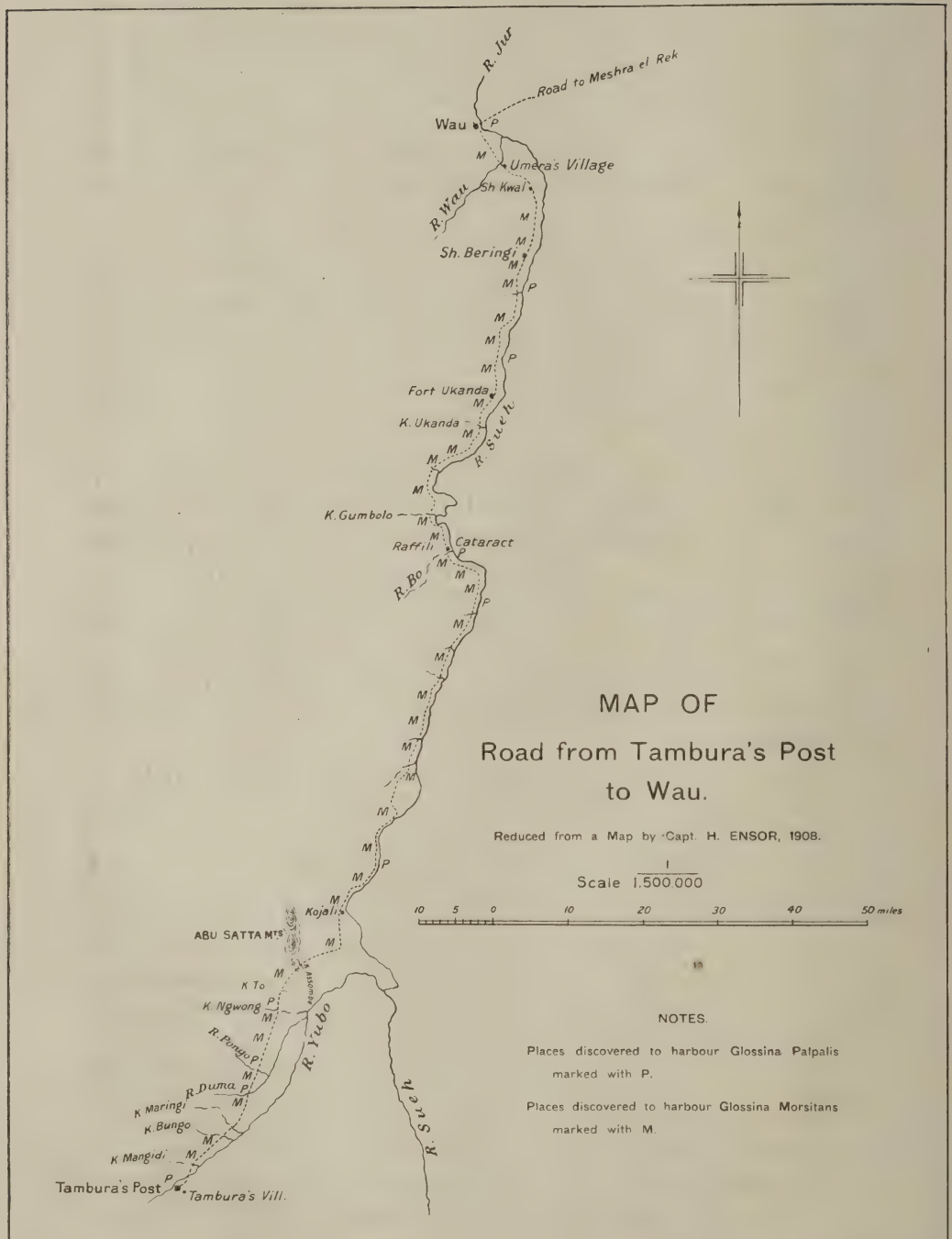
My recent investigations have shown that *G. palpalis* is extremely common in the Bahr-el-Ghazal, and it is my opinion, based on the discovery of numerous palpalis areas, that this fly is to be found everywhere in the province where the conditions necessary to its existence, deep shade near open water, are to be found.

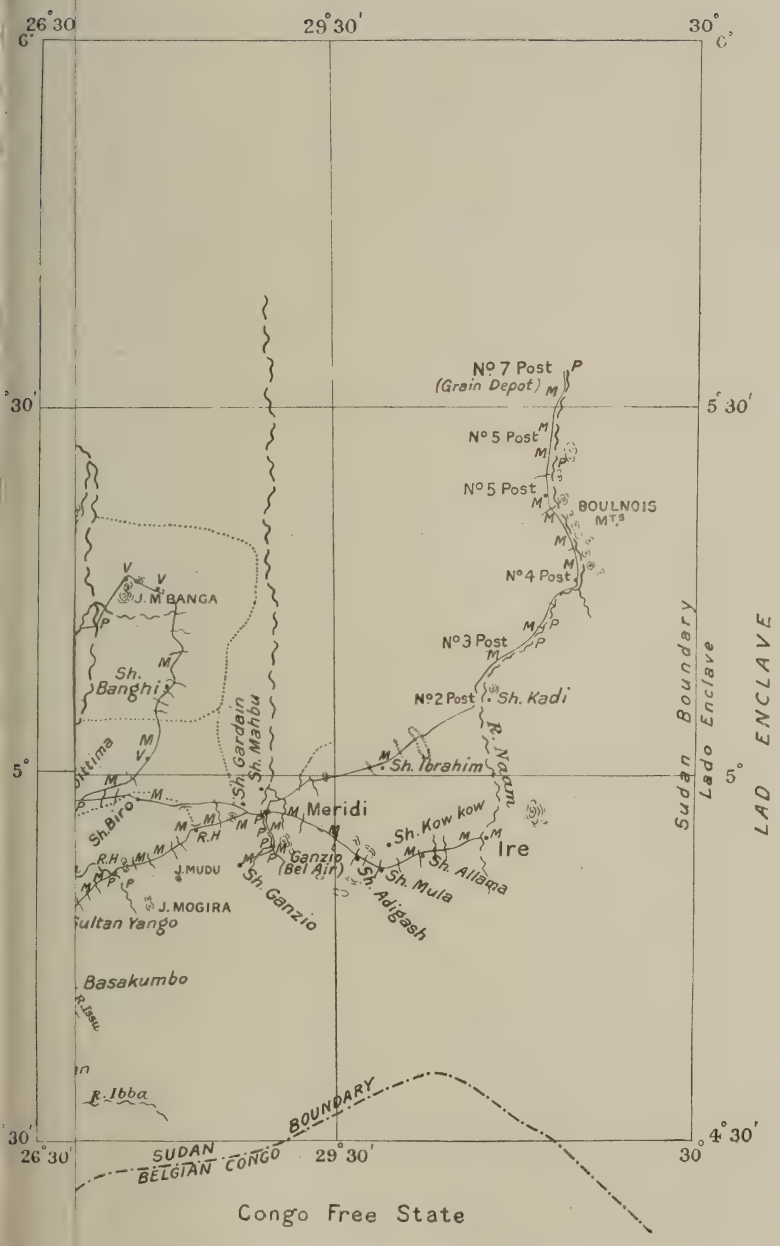
On the accompanying maps sixty-two places will be seen to be marked with a "P," which indicates that *G. palpalis* has been discovered in these localities. This number of palpalis areas, large as it is, can, however, represent only a very small fraction of the number of all the palpalis areas which must exist in this large province. It has been quite impossible for me to discover, and to chart, all such areas in the districts which have been traversed in the course of my journeys, as to attempt to do so would involve years of work; enough, however, have been discovered to show that they must be very plentiful in the Bahr-el-Ghazal. Time and other considerations have prevented me from carrying out investigations in the northern districts of the province, but it can be considered as almost certain, from the number of palpalis areas that have been discovered elsewhere in the Bahr-el-Ghazal, that *G. palpalis* also exists in the northern districts wherever conditions favourable to it are to be found. In the future it is very probable that this fly will be found as far north as the southern districts of Kordofan.

The palpalis areas discovered will now be enumerated, and it is hoped that the attached maps will make it clear where such areas are situated.

On the road from Shambé to Meridi *G. palpalis* is first met with at M'volo; from this station to No. 2 Post the road follows the Naam river, and the fly is to be found everywhere along the river-banks where a sufficiency of deep shade is afforded by the growth of large trees. At No. 2 Post the road leaves the Naam river and goes south-west to Meridi, and palpalis is absent until the Meridi river is reached.

G. palpalis is to be found everywhere along this stream, and areas were discovered in the immediate vicinity of the stations of Meridi and Ganzio. The fly was not found anywhere on the road from Meridi to Ire, a post formerly occupied by Congolese troops, and situated on the Naam river, 22 miles east of Meridi, while the neighbourhood of Ire itself was found to be free from


R. Jur
Road to Meshra el Rek
Wau
Umera's Village
Sh. Kwai
R. Wau
Sh. Beringi
Fort Ukanda
K. Ukanda
R. Sueh
K. Gumbolo
Raffili
Cataract
R. Bo
Kojali
ABU SATTA MTS
K. To
K. Ngwong
R. Pongo
R. Duma
K. Maringi
K. Bungo
K. Mangidi
Tambura's Post
Tambura's Vill.
R. Yubo
R. Sueh
MAP OF
Road from Tambura's Post to Wau.
Reduced from a Map by Capt. H. ENSOR, 1908.
Scale 1.500.000
10 5 0 10 20 30 40 50 miles
NOTES.
Places discovered to harbour Glossina Palpalis marked with P.
Places discovered to harbour Glossina Morsitans marked with M.


26° 30'
29° 30'
30°
6°
5° 30'
5°
4° 30'
No 7 Post
(Grain Depot)
No 5 Post
No 5 Post
BOULNOIS
No 4 Post
No 3 Post
No 2 Post
Sh. Kadi
J. M BANGA
Sh. Banghi
Sh. Gardain
Sh. Mahbu
R. Nagam
Sh. Ibrahim
Sudan Boundary
Lado Enclave
LAD ENCLAVE
Meridi
Sh. Biro
Sh. Kow kow
Ire
Sh. Alliaqa
Sh. Mula
Sh. Adigash
Ganzio
(Bel Air)
Sh. Ganzio
J. MUDU
J. MOGIRA
Sultan Yango
Basakumbo
R. Ibba
BOUNDARY
SUDAN
BELGIAN CONGO
Congo Free State

MAP OF

South-West Bahr-el-Ghazal.

Reduced from a Map by H. ENSOR, Capt. R.A.M.C., 1908.

NOTES.—The firm line indicates the route taken during journeys of investigation.
Areas where Glossina Palpalis has been found are marked P
Areas where Glossina Morsitans has been found are marked M.
Stations formerly occupied by Congolese Troops are underlined.
Stations occupied by troops or police are shown thus ■
Tribal boundaries are shown thus ⋯⋯ the Sheikh's village and name inserted.
Sh. is an abbreviation for Sheikh, as all headmen of villages are called in the Sudan.

palpalis, as the Naam river at this part of its course flows through an open plain, and its banks are destitute of trees of a sufficient size to afford the shade necessary to the existence of *G. palpalis*.

No less than fourteen palpalis areas are to be met with on the road between Meridi and the station of Yambio; twelve of these areas are situated along the banks of the Oonwa, Issu, Ibba, Igi, Kingo, Madebé, Meloo, Sueh, Kissi, Wo, Bassumboru, and Wezzi rivers, while the remaining two were found around pools of water in the immediate vicinity of Yambio station.

The country between Sultan Yango's village and Mount Baginze presents four palpalis areas, which are situated along the banks of the Issu, Wo-wo, Ibba, and Nairango rivers.

No palpalis areas were discovered between Mount Baginze and Sultan Mangi's village.

G. palpalis was not found along the banks of the Nakengola river, a tributary of the Congo. This stream rises from the eastern slopes of Mount Baginze, and to all appearance its banks are typical haunts for palpalis, but none could be discovered along them. Perhaps the high elevation, about 2,500 feet above sea-level, is unfavourable to the existence of this fly.

When marching from Yambio to Rikita's Post *G. palpalis* is to be met with along the banks of the Sueh, Lay, Mozimbé, Bongo, and Manza rivers, being very plentiful in the bed of the Manza river, near Rikita's Post. Only four palpalis areas were discovered between Rikita's Post and Meridi, but as this part of the Bahr-el-Ghazal had never before been traversed by any officer of the Sudan Government, or indeed by any European, and in consequence one could not be certain what one's reception by the natives might be. I was obliged to adopt every precaution *en route*, and as a result the work of the Commission suffered to some extent, as it was not safe to leave camp or the line of march in search of palpalis. Three of the four areas discovered were situated along the courses of the Gama, Ternamuka, and Ibba rivers; the fourth area was found round some pools of water in a valley near the village of a Zandeh chief called M'Bittima. Between the station of Yambio and the now unoccupied Congolese station of Wo, palpalis was found at the Werri and the Wo rivers, being very plentiful along the banks of the latter.

En route from Yambio to the station at Tambura, *via* Gindoo and Zungumbia, *G. palpalis* is to be met with at the Yabonga river, between Yambio and Gindoo, but from this place it is not to be found until the Zungumbia river is reached. Between this

river and Tambura ten palpalis areas were discovered, the most important being that along the banks of the Yobo river, near the station of Tambura. On the road between Tambura and Wau *G. palpalis* is to be found at the Duma, Pongo, and N'Gwang rivers, and it is also to be met with along the Sueh river wherever deep shade is afforded by large trees growing on the river-banks. At Wau, which is the Headquarter Station of the Bahr-el-Ghazal Province, these flies are very scarce, as nearly all the trees along the river-banks near the town have been cut down for fuel, but a few specimens can be discovered under the shade of some trees growing on the river-bank about three hundred yards to the south of the British officers' quarters.

It will be seen from the above that the palpalis areas which have been discovered up to the present time in the Bahr-el-Ghazal Province are for the most part to be found along the banks of rivers. These rivers all rise from the northern face of the Nile-Congo watershed, flow to the north, and, with the exception of the Naam and Meridi rivers, eventually join one or the other of the two great tributaries of the Bahr-el-Ghazal river. These tributaries, which also take origin from the Nile-Congo watershed, are the Sueh and the Ibba rivers. The Sueh, which is known as the Jur after it has been joined by the Wau river, flows into the Bahr-el-Ghazal river near Lake Ambadi, and the Ibba river which also changes its name and is called the Tonj river for the latter part of its course, joins the same river at Meshra-el-Rek.

The Naam and Meridi rivers are said to rise in the Lado Enclave, and they flow north to join the White Nile independently of each other. They are joined by no tributaries of any importance during their course in the Sudan.

Owing to this arrangement of rivers we have in the south of the province, near the Sudan and Congo Free State frontier, numerous riparian palpalis areas which diminish in number as the rivers flow north and join the Sueh and Ibba rivers, and when a latitude of about 6° 30′ N. is reached there are, neglecting the Wau river, about which nothing is known except that it is one of the largest tributaries of the Sueh, only four rivers of any size remaining. These rivers are the Sueh, Ibba, Meridi and Naam rivers.

G. palpalis has been found to exist along the banks of all four of these rivers in the south of the Bahr-el-Ghazal Province, and along two of them, the Sueh and the Naam rivers, the presence of the fly has been demonstrated as far north as Wau and M'volo

respectively, and there is little doubt but that it also is to be found along the banks of these two rivers up to the point where they enter the papyrus swamps which surround the Bahr-el-Ghazal river and the White Nile.

As has been mentioned previously, *G. palpalis* has been found along the banks of the Ibba and Meridi rivers in the southern districts of this province, and it is only reasonable to suppose that it is also to be found throughout the remainder of the courses of these rivers wherever the conditions are favourable to its existence. The Bahr-el-Ghazal Province can thus be said to possess four riparian palpalis areas which begin at the Nile and Congo watershed, and extend to the north through nearly the whole length of the province.

Two of these riparian areas are of the highest importance when the question of the prevention of the spread of sleeping sickness into the interior of the province comes to be considered. The two palpalis areas referred to are those along the banks of the Sueh and Naam rivers. Their importance lies in the fact that the two principal roads connecting the southern districts with the interior of the province follow the courses of these two rivers; that is to say, pass near and, in some places, through palpalis areas. In consequence uninfected people travelling north along these roads in company with infected persons will be very liable to become inoculated *en route* with the trypanosome of sleeping sickness through the agency of *G. palpalis*.

(3) Areas of Distribution of Glossina Morsitans.

G. morsitans. Arabic: "*Diban el Marad el Bohim*," "The Fly of the Cattle Disease." Zandeh, "*Pay-A.*"

This species of *Glossina* is extremely common in most parts of the Bahr-el-Ghazal Province, and forms one of the most trying of "life's little worries" to the traveller in that part of the world. It is, however, rarely, if ever, to be seen in the forest regions round the stations of Yambio, Zungumbia, N'Doruma, and Tambura; and is also absent, or nearly so, in the Dinka stock-raising country between Shambé and Rumbek, and Wau and Meshra-el-Rek.

The roads from M'volo to Meridi, from Meridi to the Bassumboru river, and from Khojali to Wau can be said with justice to swarm with *G. morsitans* for the greater part of the year, and the mortality among transport animals working on these roads from "nagana" is in consequence enormous.

On the accompanying maps localities infected with *G. morsitans* have been shown as far as possible by marking the place with an "M."

(4) Habits, &c., of Glossina Palpalis.

G. palpalis is in my experience very rarely to be found except in the immediate vicinity of the open water of rivers and pools, and it is also only to be found in such places when deep shade is afforded by large trees growing along the banks of the rivers and pools. It is also necessary that the foreshore running down to the water should be open, and not covered with papyrus, reeds, lilies, &c.

The presence of steep banks, thick bushes, long grass, and especially of any kind of low-growing vegetation which covers the ground with leaves, is especially favourable to *G. palpalis*, but the shade of large trees is in my experience absolutely essential, as it has never been my lot to find this fly along the banks of water-courses destitute of trees, even though appreciable shade may exist in such places from the presence of thick scrub and long grass.

Many of the rivers in the Bahr-el-Ghazal flow through papyrus swamps for long distances, and in such marshes *G. palpalis* is never to be found, even though it may abound along other stretches of the same river where the banks are steep and well wooded.

The absence of *G. palpalis* from papyrus swamps is usually, I believe, said to be due to there being no foreshore in such places even if open water exists, and also to swamp vegetation not affording sufficient protection from the rays of the sun. In my opinion a more important reason than either of these is the absence of dry ground in such places.

G. palpalis, as far as my observations go, usually when at rest remains on the earth hidden from view by the leaves of any low-growing form of vegetation which may be present, or under cover of fallen leaves, and never settles for any length of time on the branches and foliage of trees and bushes.

We now know also, owing to Dr. Bagshawe's most important discovery, that dry earth is necessary to the female flies for the deposition of their pupæ. In a papyrus swamp little, and in the rainy season no dry earth is to be found, and in consequence such places afford no resting-place for this fly, and no suitable ground for the females to deposit their pupæ.

This appears to me to be perhaps the chief reason why *G. palpalis*

is not to be found in papyrus swamps, as a very appreciable shade is afforded by a tall well-grown papyrus, and trees are by no means invariably absent from such places. An abundant food supply is also frequently present in papyrus swamps, as these places are the favourite haunts of crocodiles and hippopotami, from which creatures, according to Professor Koch, *G. palpalis* obtains a large part of the blood necessary to its existence.

Very often in the Bahr-el-Ghazal Province a river for some parts of its course flows between banks, one of which is high and covered with large trees and scrub, while the other is swampy and fringed with papyrus; *G. palpalis* can be found, often in large numbers, on the one bank, but never on the other. The Meridi river at Ganzio for about three miles of its course presents all the conditions described above under which palpalis is, and is not, to be found.

G. palpalis has never come to my notice in any area by merely passing through it, and the casual examination of the banks of streams and pools is quite useless as a means of determining its presence or absence in such places. The fly, in my experience, does not, as a rule, immediately attack anyone entering its haunts, but an interval of time, which may amount to several minutes, often elapses before a single fly is seen.

The interval of time referred to depends very largely on whether the place under observation is, or is not, one regularly frequented by human beings, such as a ford or watering-place near a village. In such a place in two or three minutes, or less, several flies will usually be seen, while in the case of an unfrequented part of a palpalis area it may be necessary to wait half an hour, or even more, before a single specimen puts in an appearance.

To determine whether *G. palpalis* exists in any suspicious locality it is necessary to sit down quietly in the deepest shade available near the margin of the open water of a stream or pool, and to wait there patiently for at least an hour before one can say with any degree of certainty that *G. palpalis* is absent.

In choosing a place for making observations as to the existence or otherwise of these flies it is very necessary, if there is any wind blowing, to select a place well sheltered from it, as *G. palpalis* appears to object to wind almost as much as it objects to direct sunlight. Usually, after waiting a variable length of time in a likely place, two or three, or more, specimens will be seen flitting quickly and settling only for a second or two; even with a net they are extremely difficult to catch off one's own person, as they are very

shy and retiring, and usually settle out of sight on the inaccessible part of one's body.

It is almost absolutely necessary, if specimens are to be obtained, to take a native with one, and to make him sit at a convenient distance, and then to catch the flies with a net as they settle on his body. In this way there is not much difficulty in obtaining specimens, but *G. palpalis* can never be said to be easy of capture.

This employment of a native as a *corpus vile* is highly inconsistent with the sermons one preaches to natives about the danger of allowing themselves to be bitten by these flies, and for a long time I have tried to be consistent, and to do without such assistance.

To anyone with sufficient experience *G. palpalis* can be identified, without actually catching a specimen, by the peculiar buzzing noise it makes when flying, and by the quick darting way in which it flits from place to place when not actually engaged in sucking blood.

It never appears to be very persistent in its attempts to obtain a meal of blood, and very frequently, too frequently from the collector's point of view, it will disappear after one or two unsuccessful attempts have been made to capture it. In this way it differs very markedly from its relative *G. morsitans.*

When seated waiting for the appearance of *G. palpalis* it is a good plan to instruct a native to disturb the fallen leaves and low-growing vegetation with a long cane ; this drives the flies from their resting-places, and very often several will, in consequence, make their appearance and attempt to make a meal off the disturber of their repose.

G. palpalis can, and often does, bite through clothing, but it naturally much prefers to feed off the bare skin, and if one is accompanied by a native, who is usually in this part of Africa entirely naked except for a loin-cloth, it is quite noticeable how few flies will settle on oneself, and how many will attempt to feed off the unprotected native. Clothing is undoubtedly a great protection, although not by any means an absolute one, and from many careful observations I believe that white clothing confers the greatest degree of immunity from the attacks of these insects. This is a point of some importance to people living in or near palpalis areas, and who are in consequence exposed to the bites of these flies.

With regard to the hours of the day during which *G. palpalis* is most active, these hours, in my opinion, depend very largely on the season of the year, and on the atmospheric conditions.

In the Bahr-el-Ghazal Province in the dry season *G. palpalis* appears to feed most freely between the hours of 8 a.m. and 11 a.m., and is not, as a rule, much in evidence after these hours. This is, perhaps, to be explained by the fact that in the dry season a strong wind sets in daily about 11 a.m., and continues blowing until late in the afternoon; *G. palpalis* objects very strongly to wind, and in consequence, when a breeze springs up, it retires to the shelter of undergrowth, fallen leaves, &c. In the rainy season the hours during which *G. palpalis* can be said to be most active cannot be so definitely stated.

When a day at this time of the year opens fine, with a bright hot sun and little or no wind, the hours during which *G. palpalis* is most in evidence are those which prevail in the dry season, viz., 8 a.m. to 11 a.m. During rainy or dull weather the flies do not appear to feed at all, but I have often noticed them to be quite active late in the afternoon when a day which began with rain had cleared up, and the sun was shining brightly. In consequence, it may be assumed that, while in a palpalis area one is entirely safe at no hour of the day, after 5 p.m. the danger of being bitten by this fly is very small at any time of the year.

(5) Habits, &c., of Glossina Morsitans.

This fly abounds in countless numbers in most of parts of the Bahr-el-Ghazal, and those districts of the province where its presence was not noted have already been mentioned. *G. morsitans* appears to feed most freely from immediately after sunrise until about 11 a.m., becoming again troublesome about 4 p.m., and continuing to annoy both man and beast alike until the last ray of light has died out of the sky. It is extraordinarily greedy of blood, and appears to be quite indifferent to the chances of destruction when intent upon obtaining a meal of blood. *G. morsitans* does not seem to be dependent in any way upon water and deep shade for its existence, and is often to be seen in large numbers miles distant from the nearest stream or pool. These flies are, however, often seen to be extremely numerous near rivers; for example, the two worst roads in the province, with respect to the numbers of *G. morsitans*, are the roads from M'volo to Meridi and from Khojali to Wau, which roads follow the courses of the Naam and Sueh rivers. This is not due to water being necessary to *G. morsitans*, but to the fact that big game is found in great numbers along these rivers, and in consequence attracts the flies to such places.

G. morsitans is sometimes to be found in forest lands, but never in large numbers, and appears to prefer lightly wooded plains covered with high grass.

This fly, unlike its relative *G. palpalis*, bites extremely freely in dull and rainy weather, and swarms of them will follow a caravan of carriers or transport animals for miles, paying particular attention to the leading men or animals. The amount of discomfort which these flies cause the traveller in the Bahr-el-Ghazal has to be experienced before it can be adequately realised. When marching through a district infested with them all the exposed parts of one's person quickly become covered with bites, which cause an intense and lasting irritation. It is quite impossible to ward off these attacks, and they have to be endured as one of the necessary evils of service in that part of the world.

G. morsitans, as far as my experience goes, is most numerous soon after the first rains of the season have set in, and is least in evidence immediately after the grass has been burned off; they are, however, always very plentiful in very many parts of the province, and are one of the greatest obstacles to the development of the country, owing to the enormous mortality they cause among transport animals by infecting them with the trypanosome peculiar to "nagana."

The blood supply of *G. morsitans* must be furnished for the most part by the countless herds of big game which exist in this province, but on roads frequented by transport animals and men these flies obtain from them no small portion of the blood necessary to their existence.

(6) Variation in Numbers of Glossina palpalis during the Wet and Dry Seasons of the Year.

In the Bahr-el-Ghazal *G. palpalis* is undoubtedly much more numerous during the rainy than during the dry season. I make this statement with entire confidence, as I have passed both seasons of the year in this province, and have had many opportunities in many palpalis areas of noticing what a great diminution takes place in the numbers of *G. palpalis* after the dry season has set in. This diminution is due, in my opinion, firstly to the fact that in the Bahr-el-Ghazal at the beginning of the dry season the trees lose their leaves, and thus provide less shade for the protection of these flies; and secondly, that after a few weeks of dry weather forest fires rage through the country, and burn particularly fiercely along

the banks of rivers and pools, where the long, dry, thick grass and fallen leaves supply an abundance of fuel. By these fires millions of adult flies must be killed, and in addition it is probable that large numbers of their pupæ are also destroyed owing to the heat generated by the slow burning of the dry leaves which may cover the ground in which they have been deposited. Immediately after a fire in a palpalis area, specimens of *G. palpalis* can, as a rule, only be discovered in those parts of the area which have for some reason or the other escaped the flames.

When the dry season is far advanced many of the rivers cease to flow, and form pools, and it is only in the vicinity of these pools that *G. palpalis* can be discovered, and even in such places at this time of the year they are far from plentiful. Perhaps also during the dry season, owing to the somewhat unfavourable conditions, the fecundity of *G. palpalis* is much diminished. During the rains this species of *Glossina* can be found practically wherever the necessary conditions of open water and deep shade are to be found, and I have observed this fly during the rainy season in the neighbourhood of pools of water in a valley near the station of Madebé, all of which pools dried up during the dry weather, with, as a consequence, the entire disappearance of *G. palpalis*. The Zandeh natives living near these ponds informed me that they always dried up every year. Doubtless the disappearance of these flies will be followed by their re-appearance with the onset of the next rains, and if this does happen it can only be due to some of the pupæ, which have been deposited during the rainy season, not developing into adult *Glossinæ* until the dry season has passed away, as these pools are situated nearly a mile distant from the nearest permanent palpalis area, that along the Madebé river, and the country intervening is more or less open, and in consequence unlikely to encourage immigration on the part of the flies from one palpalis area to another.

(7) Food Supply of Glossina palpalis.

The blood necessary to the existence of these flies is undoubtedly obtained in great part from man in inhabited districts, a statement which is sufficiently proved by the large numbers of flies to be found round the watering-places near villages, but as the fly also exists in entirely uninhabited districts its food must be obtained from the big game which is extraordinarily numerous in such places. The animals most frequently seen near water are the

water-buck, bush-buck, roan antelope, hartebeest, buffalo, wart-hog, and many varieties of monkeys and baboons.

In the southern part of the Bahr-el-Ghazal Province the numerous rivers which rise from the northern face of the Nile-Congo watershed are not sufficiently large to harbour many crocodiles and hippopotami. These creatures are, however, very numerous in the larger rivers, in the Naam, the Ibba and the Sueh, and must furnish *G. palpalis* with a large proportion of its food supply.

It has lately seemed to me to be possible that the flies may obtain some of their food from large birds. I have formed this opinion because, while on the march from Tambura to Wau, along the Sueh river, Captain Brakenridge, R.A.M.C., Senior Medical Officer of the Province, called my attention to a large hawk perched on a tree near the river. On this bird, with the aid of a pair of Zeiss field-glasses, a fly, which was almost certainly a *G. morsitans*, could be seen, and it appeared to be trying to get under the wing of the bird, which was quite unconscious of its presence. Perhaps *G. palpalis* may in like manner obtain some of its food supply from the larger wading birds.

(8) The Extent of the "Range" of Glossina palpalis and the Conditions controlling it.

In this report the word "range" means the distance to which *G. palpalis* will wander from the shelter of trees and scrub growing in the immediate vicinity of open water.

The range of *G. palpalis*, in my experience, depends upon the presence or absence of shade in the immediate neighbourhood of the palpalis area, together with the presence or absence of *G. morsitans* in the immediate vicinity of such an area.

In the case of a palpalis area being situated along the banks of a stream or pool in a thickly wooded district, the flies are able to leave the shelter of the trees growing along the edge of the water, and to proceed for a variable distance away from the water without emerging into the direct rays of the sun. *G. palpalis* can and will do this if *G. morsitans* does not exist in the neighbourhood, but even under these conditions it is probable that the fly never wanders more than 10 to 20 yards from the water, unless induced to do so in the hope of obtaining a meal of blood by following a man or some animal. If the conditions of shade near a palpalis area are favourable, but *G. morsitans* also exists, I find by

experience that *G. palpalis* never leaves the shelter of the trees growing round the water, and I believe, from observations on the behaviour of these two species of *Glossina*, that they possess definite spheres of influence, and never encroach upon each other's hunting-grounds.

Nearly all the palpalis areas enumerated in Section 2 of this report, with the exception of those at Yambio, Zungumbia, and those met with to the west of this last-named station as far as and including that on the Yobo river at Tambura, are situated in country which contains *G. morsitans* always in considerable and sometimes in enormous numbers. It follows, therefore, that the palpalis areas situated in what may be called the "Morsitans Country" can be described as possessing length with extremely little breadth, as the flies in them, owing to the presence of *G. morsitans* in the neighbourhood, are confined strictly to their own particular sphere of influence—that is to say, to the shade of trees growing along the banks of streams and pools. I have on several occasions caught large numbers of tsetse-flies when seated in the shade of trees growing a yard or two from the edge of the banks of a river which I knew harboured *G. palpalis* in considerable numbers, and on every occasion all the tsetse-flies captured belonged to the species *G. morsitans*. The converse of this also holds good, and I have never been able to capture specimens of *G. morsitans* in a palpalis area—that is to say, in the shade of trees growing along the banks of a stream or pool, even though countless numbers of these flies were to be found immediately beyond the edge of the banks of such a stream or pool.

In their enthusiasm for blood-sucking, many flies of the species *G. morsitans* will often follow one into a palpalis area, but they almost invariably disappear in a minute or two, their place being taken by hungry specimens of *G. palpalis*.

The range of *G. palpalis* from areas situated in parts of this province where *G. morsitans* either does not exist, or is very rarely seen, is sometimes considerable, and at Yambio and Zungumbia I have several times noticed specimens of this fly in the forest about two or three hundred yards from the nearest pool; the hope of obtaining a meal of blood having evidently in these cases induced them to follow human beings to such a distance from the immediate vicinity of water. Flies found at such distances from water are, however, very few in number, and the normal range of *G. palpalis* in the absence of *G. morsitans* is probably not more than from ten to twenty yards.

Solitary specimens of *G. palpalis* are sometimes met with in houses situated long distances from the nearest palpalis area, and surrounded by a zone of cleared ground. The presence of these flies in such places should, perhaps, be regarded as accidental, and those seen are probably flies which have developed from pupæ which may have been carried up in the roots of grass used for repairing the roofs of the houses, or brought up from a palpalis area in some other way.

(9) The Existence or otherwise of Sleeping Sickness in the Bahr-el-Ghazal Province.

During the period of eleven months in which investigations have been carried out in the Bahr-el-Ghazal, over 4,000 natives living in the district adjacent to the Congo Free State and French Congo frontiers have been examined for the presence of symptoms due to sleeping sickness, and only nine persons were discovered who were suffering from enlargement of the cervical glands to a degree which could in any way be described as suspicious of this disease. The operation of gland puncture was performed on four of these cases with a negative result; the other five refused to submit to the operation, and for obvious reasons no pressure was applied to induce them to submit to it.

A slight, usually very slight, degree of enlargement of the cervical glands is sometimes noticeable among the natives in this part of Africa, but it is, in my opinion, entirely unconnected with trypanosomiasis, being due to irritation caused by pediculi, which are very common among the natives in the Bahr-el-Ghazal, especially among those who wear their hair in fantastic patterns, the preservation and adornment of which are incompatible with cleanliness of the scalp.

The enlargement of the cervical glands in the nine cases mentioned above was of a slight degree only, but as a precautionary measure gland puncture was performed on those willing to submit to it, with the result that no trypanosomes could be found in the gland juice.

The method of puncture employed was that described by Captain Gray and the late Lieutenant Tulloch, and if the operation is carried out exactly as described by them no difficulty whatever is experienced in obtaining a drop of gland juice sufficiently large for microscopic examination. The blood of a large number of natives living near the Sudan Government Station

at Meridi was examined microscopically, and in no case were any trypanosomes seen, the only parasites which came to my notice in films of fresh blood being the *Filaria nocturna* and *F. diurna.*

In connection with filaria, it may be of interest to mention that *Filaria nocturna* is very common amongst the natives in the south of the Bahr-el-Ghazal Province, but they seem to suffer from the results of its presence to a very slight extent. Lymph glands in the groin are to be seen, but are not common, and only one case of elephantiasis has come to my notice.

Attempts to obtain blood films from natives living far away from the Government stations usually ended in failure, as most of them, when invited to supply a drop of their blood for scientific purposes, "stood not upon the order of their going," but left at once.

It is only in the neighbourhood of Meridi that the natives have any confidence in, or affection for, the Government officials, and this is to be explained by the fact that in the Meridi district the population is composed of people known collectively as the Gebelowi tribes, because they are said to have originally come from the banks of the Bahr-el-Gebel (the White Nile) in the Lado Enclave. These races have been released from the cruel tyranny of the Zandeh Sultans as a result of our occupation of the Southern Bahr-el-Ghazal, and really appear to be grateful for what has been done for them, and to be very friendly to the Government in consequence. These Gebelowi races also have confidence in our methods of treating diseases, and attend the Civil Hospital at Meridi in large and ever-increasing numbers.

In addition to the examination of natives wherever possible, most of the principal chiefs in the southern and western parts of the province were personally questioned as to the existence of sleeping sickness among their people, which in this part of Africa is known as the "French disease," because the people first heard of and noticed it among the troops of the Congo Free State—the natives not discriminating between French and Belgian nationalities. Most of the chiefs know the early symptoms of sleeping sickness, and they were carefully explained to those who declared themselves to be ignorant of them. They one and all declared that up to the present sleeping sickness does not exist among the people over whom they rule.

This evidence can be considered as of some value in respect to that part of the country lying between Ire, on the east, and Madebé, on the west, as in this part of the province the natives

are well disposed towards the Government, most of them belonging as has been previously mentioned, to one or other of the Gebelowi tribes, while the powerful Zandeh Sultan, Mangi, who lives near Madebé, can also be considered as friendly.

Such evidence is, in my opinion, of little value with regard to the districts round Yambio, Wo, Gindoo, Bekki, and N'Doruma's Post, where the chiefs, although under the Sudan Government, and made to respect the "Pax Britannica," are anything but well disposed towards it, as our occupation of the country has in their case resulted in the total abolition of their favourite pastime of raiding tribes weaker than themselves, and has also prevented them from indulging their natural inclination for cruelty. My travels in this part of the Bahr-el-Ghazal have been practically useless, as far as getting into touch with the natives is concerned, as the people for the most part avoided me as much as possible. In this part of the province it is very possible that if cases of sleeping sickness exist at the present time, or should occur in the near future, no information whatever will be given to the Government. The people also dwelling near Yambio take little advantage of the facilities for medical treatment afforded to them; this is probably due to the chiefs discouraging their people from attending for treatment at the Civil Hospital. However, this unsatisfactory state of affairs can be said to be slowly improving, and it may with confidence be expected that in the course of two or three years the suspicion of the people will disappear in proportion to the decline of the influence of their chiefs.

One chief, M'Vutoo, who is so often wrongly referred to as N'Doruma, and whose chiefdom is situated in the south-west of the Bahr-el-Ghazal, along the Sudan and Congo Free State frontier line, told me that he had been informed that the natives in the Congo Free State were attacked in large numbers by sleeping sickness. It is, however, impossible to say how much truth there may be in this man's statement.

This denial of the existence of sleeping sickness among their people on the part of the various chiefs, taken in conjunction with the fact that no cases of the disease among the natives came to my notice, may on the whole be accepted as fairly strong evidence that no cases presenting symptoms of the disease at present exist in the Bahr-el-Ghazal; but, owing to the long period of time —several years according to some authorities—which may elapse after inoculation with the trypanosome peculiar to this disease before the onset of the first symptoms, it is very possible and, for

reasons which will now be set forth, even probable, that incipient cases, as yet showing no glandular enlargement or other symptoms, may exist in the south of the Bahr-el-Ghazal Province.

This part of the province was occupied for a period of about three years by troops of the Congo Free State. Their stations were situated at Ewe, Ire, Ganzio (Bel Air), Yango, Madebé, Wau, Gindoo, and Bekki. All of these stations, which are shown underlined on the accompanying map of this part of the province, were, with the exception of Yango, until quite recently occupied by Congolese troops.

Several cases of sleeping sickness occurred among the garrisons of these posts, the disease, of course, having previously been acquired during service in the Congo Free State or the Lado Enclave. I saw one case of this disease at Ganzio, and proved the diagnosis to be correct by microscopical examination of the blood.

My information regarding the occurrence of the other cases is derived from Belgian officers whom I have met in the course of my journeys, and whose kindness and courtesy to me, on all occasions when I have come into contact with them, I now take the opportunity of acknowledging. During the Belgian occupation of this portion of Sudanese territory the natives living near their posts were largely employed as carriers, and were thus brought into close contact with the Congolese troops. It is only reasonable to suppose that many of these soldiers had trypanosomes in their blood, and as we now know that *G. palpalis* abounds in that part of the Bahr-el-Ghazal under discussion, it is only too probable that some of our natives have acquired the infection of sleeping sickness through their association with Congolese troops, and will in due course develop symptoms of the disease.

This is the more probable when it is remembered that carriers and their escort when on the march are naturally halted for water and rest, when the heat of the day begins, in the shade of trees growing along watercourses; that is to say, are halted at the time and in the places where infection is most likely to occur through the agency of *G. palpalis*.

From the above considerations it appears to me almost too much to expect that all our natives have entirely escaped infection with the trypanosome of sleeping sickness, and I believe cases of this disease may be expected to occur in the near future among the tribes dwelling in what was formerly the territory in dispute between the Congo Free State and Sudan Governments. In con-

clusion, for the reasons stated, the question as to whether sleeping sickness exists at the present time in the Bahr-el-Ghazal cannot be answered either in the affirmative or in the negative.

(10) The Probability, or otherwise, of Sleeping Sickness becoming Prevalent in the Bahr-el-Ghazal Province.

It can be considered as certain that sleeping sickness exists, and is likely to increase, in the Lado Enclave, Congo Free State, and French Congo, but unfortunately there is no definite information to hand with regard to the extent of the infection in these territories, or as to whether the disease is prevalent among the tribes dwelling near the frontiers of the Bahr-el-Ghazal Province. We know, however, that it has made its appearance in the above-mentioned territories, and, as the Bahr-el-Ghazal abuts on all three of them, it is very probable that sleeping sickness will, sooner or later, be brought across the frontiers, supposing that this has not already occurred.

Sleeping sickness will probably be introduced into the Bahr-el-Ghazal from the Congo Free State, and not from French Congo, or that part of the Sudan at present leased to His Majesty King Leopold, the Lado Enclave, for the following reasons :—

Between the Bahr-el-Ghazal and the Lado Enclave is a wide tract of uninhabited country which is rarely traversed by natives, as no intertribal trade can be said to exist. The contrary is, however, true with regard to the Bahr-el-Ghazal Province and the Congo Free State.

The tribes dwelling on each side of the Nile-Congo watershed, which constitutes the frontier line between the Sudan and the Congo Free State, are for the most part of the Zandeh race; intercourse between our natives and those under the sovereignty of the Congo Free State is very free, and it will be found quite impossible to prevent it, supposing that it should in the future be considered advisable to do so. Intertribal intercourse in the Bahr-el-Ghazal is now everywhere much freer than formerly, owing to the Anglo-Egyptian occupation of the country having put an end to the almost constant warfare which formerly prevailed among the various tribes, and this intercourse will become even freer in the future as the country is developed and trade increases. The same is also doubtless true of the northern territories of the Congo Free State.

The Nile and Congo watershed presents, unfortunately, no

natural barrier such as a range of high mountains; indeed, when travelling in this part of Africa one is often in doubt as to whether the frontier, that is to say the watershed, has been crossed or not, as, with the exception of Mount Baginze and a few other isolated mountains, the watershed is nowhere definitely marked, and is really represented by one of the several low ridges met with when travelling south towards the Congo Free State.

One can only be sure that the frontier has been crossed by finding a stream which definitely flows to the south. In consequence, infected natives may, and probably do, come into the Sudan from the Congo Free State, and in this way sleeping sickness is almost certain to be carried into the Bahr-el-Ghazal, if it has not already found its way there. The number of infected natives at present who may visit our territories must be small, but in the future, if sleeping sickness increases to any great extent among the natives in the Congo Free State, in all probability large immigrations into the Bahr-el-Ghazal will take place on the part of the natives in the infected districts, in the hope that they will escape the disease by immigrating to a country which is free, or nearly free, from it. Such immigrations will be impossible to control, as, owing to the great extent of the frontier, and the slender manner in which it is policed by both the Governments concerned, mere orders to natives to stay in their own districts will almost certainly be disregarded. If such immigrations take place on the part of the natives in the hope of escaping the disease in question, nothing can prevent sleeping sickness from probably becoming widespread in the Bahr-el-Ghazal unless proper precautions are taken to limit it before, and not after, the disease has become common among the natives living in this province.

Sleeping sickness is stated to have found its way into the French Congo by extension from the Congo Free State, but it can hardly yet have made much progress in that part of the French Congo which borders on the Sudan, and it is not probable that the Bahr-el-Ghazal will be invaded by the disease from this quarter before several years have elapsed, especially when it is remembered that the tribes living along this frontier line are for the most part still independent, and on this account in all probability limit all intercourse with their neighbours to occasional raids upon them. This action on their part certainly prevents intertribal intercourse from becoming free, and in this way checks the spread of sleeping sickness.

It is the civilisation of Africa, with the consequent increase of

trade and improvement of the means of communication, that has enabled sleeping sickness to overrun the Continent by extension from the West.

In conclusion I believe that the chief danger at present, and for some time to come, lies in the extension of the disease from the Congo Free State, and it would be carrying optimism to an unjustifiable extent to hope that the Bahr-el-Ghazal will entirely escape the ravages of this disease, especially when the experience of other countries has taught us that it almost invariably, sooner or later, makes its appearance in districts where *G. palpalis* is to be found, and where free intertribal intercourse exists. Such a district is the Bahr-el-Ghazal Province of the Anglo-Egyptian Sudan.

(11) Remarks, &c., on the Measures to be Adopted to limit the Spread of Sleeping Sickness in the Bahr-el-Ghazal.

Sleeping sickness, as far as our knowledge of the disease at present extends, is, certainly for the most part, transmitted from man to man by means of the *G. palpalis*.

G. morsitans is, I believe, generally considered not to be a carrier of this disease, although it certainly is the carrier of that very similar disease which is so destructive among our transport animals, and which is known in the Sudan as "nagana." Experiments are, I believe, in progress in other parts of Africa with the object of ascertaining if it is possible for the trypanosome of sleeping sickness to be transmitted from man to man by this fly; and it is sincerely to be hoped that it cannot be so transmitted. If it should prove to be capable of transmission by *G. morsitans*, and sleeping sickness should make its appearance to any great extent in this province, it is to be feared that, owing to the enormous numbers of *G. morsitans* which exist in many districts, the human race will almost cease to exist in such places.

Efforts to prevent or to limit the spread of sleeping sickness must in the first place be directed towards banishing the fly as far as possible from inhabited districts. We know from the experience of the Uganda Protectorate that the best way of making a place palpalis-free is to clear away all trees and scrub from the banks of rivers or pools near which *G. palpalis* abounds: that is to say, to deprive these flies of the shade necessary to their existence.

It is manifestly impossible to cut down all the timber growing

along the banks of all the rivers and pools in the Bahr-el-Ghazal Province, but as the range of *G. palpalis* from water is very small, it follows that all that is necessary to protect people living in a town from the attacks of these insects is to clear away all trees, &c., from the vicinity of watering, washing and bathing places for a radius of at least fifty yards from such places. This is not a very great undertaking, and has been already carried out, on my recommendation, by Captain Teacher at Yambio, and by Captain Spencer at Ganzio, and has been entirely successful as far as Ganzio is concerned. At Yambio, however, the conditions are such that it will be extremely difficult to make the station palpalis-free, and, in spite of the great amount of work the garrison has done under Captain Teacher's supervision, I am inclined to think that the troops will again be exposed to the attacks of *G. palpalis* as soon as the oncoming rainy season shall have set in, with the consequent increase in the numbers of these insects. On account of this I wrote to the Governor of the Bahr-el-Ghazal Province, stating that this station should be abandoned, and another one built at some convenient place in the neighbourhood where the conditions are such that it can be made palpalis-free.

In addition to the clearing away of all shade near watering-places, orders must also be issued that water is only to be drawn between the hours of 5 a.m. and 8 a.m., and from 4 p.m. to 6 p.m., and, as far as possible, all washing and bathing should be confined to these hours, which are the hours of the day during which *G. palpalis* is known to be least active.

It is imperative, in my opinion, that the officers in command of all Government stations in the Bahr-el-Ghazal Province should be ordered to make arrangements immediately on these lines for the purpose of safeguarding the troops and civilians living in such stations from the attacks of *G. palpalis*.

When the question of the prevention of the spread of sleeping sickness among natives living in their own villages, and under the immediate rule of their own chiefs, comes to be considered, it will be found to be a very serious question, and one of immense difficulty. In my opinion the best way of carrying out precautionary measures in the native villages will be to make each ruling chief, or sultan, as he is called in the Southern Bahr-el-Ghazal, attend at the nearest Government station in order that he may see for himself what measures are necessary to prevent his people from being bitten by *G. palpalis*, and to give him a small yearly subsidy, which he is to understand will only be paid to him on the condition that

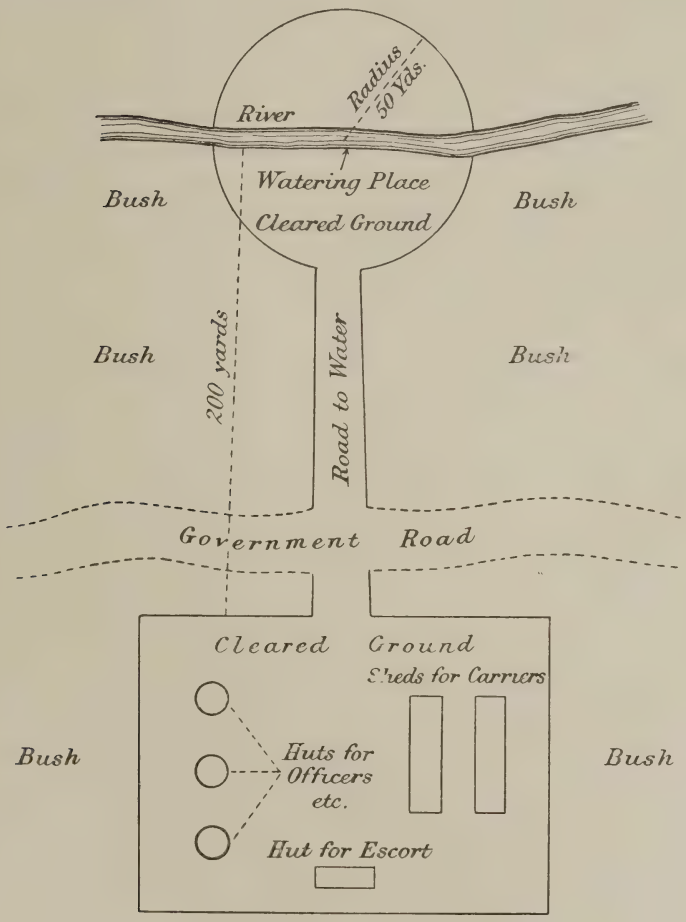
the watering-places near his villages are kept free of trees and scrub, and that he immediately reports all suspicious cases of sleeping sickness to the nearest Government official. If this work be not done, or is neglected to some extent, he is to lose the whole or part of his subsidy, and if he be found to be either unwilling or unable to carry out the work required of him, he should be deposed and another chief appointed in his stead. An arrangement of this kind might have some effect, and the danger of being bitten by *G. palpalis* must also be continually impressed upon both chiefs and people alike. The more intelligent Zandehs are quite aware of the difference between the two species of tsetse-fly to be found in the Bahr-el-Ghazal, and, as has been mentioned before, *G. palpalis* is in their language called "N'gunga" and *G. morsitans* "Pay-ā."

Sleeping sickness, when it makes its appearance in the Bahr-el-Ghazal, will probably be disseminated to a great extent by carriers, unless measures are taken to prevent it. Carriers are collected as required by the Government from large areas, and it will be quite possible in the future that 3 to 4 per cent. of such carriers may be suffering from trypanosomiasis even when they may present no definite symptoms whatever.

Carriers, when on the march and halted for water and rest during the heat of the day, naturally, unless prevented, go down to the water to drink and to rest in the shade of trees overhanging the water; that is to say, to rest in a palpalis area in the majority of cases; and in this way previously healthy natives will become infected from their already diseased fellows through the agency of *G. palpalis*. In consequence, unless careful precautions are taken to prevent it, the Government, in employing carriers, will at the same time be spreading a disease which it is its duty to suppress by every means at its disposal.

The following precautions are accordingly necessary, and should be carried out with as little delay as possible:—The halting-places on the Government roads are known, and every one of these halting-places must be treated as if it were a station in the occupation of troops. The watering-places in use must be cleared of all trees, scrub, &c., for a radius of at least fifty yards, and rest-houses for the use of carriers should also be constructed. Most of the halting-places on the roads already have rest-houses for the use of officers and other officials. The rest-houses for officers, troops, carriers, &c., should be built on a cleared area of ground situated at least 200 yards from the nearest palpalis area, *i.e.*, from the nearest water. The houses for the use of carriers should consist of long, well-thatched sheds, open at the sides.

Orders should be issued to those concerned that on the arrival of a party of carriers at one of these halting-places they should be marched down to the cleared watering-place, and when they have obtained the water they require they should be taken to their rest-houses, and made to understand that they are on no account to



leave them, and wander about the banks of the river or pool which forms the water supply. Carriers will not object to these orders as the shade afforded by a good rest-house is much preferable to that of trees.

The accompanying diagram of one of the proposed halting-places

to be established on all Government roads in the Bahr-el-Ghazal will perhaps explain what is meant by the above.

All carriers collected in the southern districts of the Bahr-el-Ghazal before being allowed to leave the station at which they have been mustered, should be examined by a medical officer for symptoms of sleeping sickness, enlarged cervical glands, &c., and all men presenting any symptoms suspicious of the disease should be detained and the suspicions set at rest by examining the gland juice for trypanosomes.

In the future, if sleeping sickness succeeds in establishing itself in the Bahr-el-Ghazal, segregation of those attacked by the disease will have to be attempted. On this account I believe that every care should be taken of the old Congolese forts at Ire and Gindoo. They are well suited for use for this purpose, as they are both situated in the palpalis-free districts, at no great distance from our stations of Ganzio and Yambio respectively.

The precautions outlined above, if carried out properly, should certainly prevent natives from becoming infected with sleeping sickness while engaged in carrying, and should also prevent the disease from making its way into the interior of the province by means of such carriers. The danger of sleeping sickness being introduced into the interior of the Bahr-el-Ghazal is enhanced by the fact that the two principal roads connecting the southern districts with the interior follow the courses of the Naam and Sueh, and that *G. palpalis* is to be found along the banks of both these rivers. This has already been referred to in Section 2 of this report. The road from Khojali to Wau is not used in the rainy season, as at that time of the year enough water is to be found on the shorter and more direct route which lies to the east of the river road. In the dry season, however, all transport uses the river road, and it is imperative that rest-houses should be constructed, as suggested above, so as to diminish the chances of travellers becoming infected with sleeping sickness in the future. At present no rest-houses of any kind have been constructed along this road.

The route from Meridi to M'volo is used all the year round, and possesses fairly good rest-houses situated outside the range of palpalis, but little or no clearing has been done round the watering-places.

The station of M'volo must be made entirely palpalis-free, as it is used as a place of rest for a day or two by carriers from the South *en route* to Shambé or Rumbek, and on this account, if it is not very carefully made palpalis-free, may become a centre for the dis-

semination of sleeping sickness. If it should be found impossible to make M'volo palpalis-free, and from my experience of it I am inclined to think there is some possibility of this, the station must, at any cost or inconvenience, be removed to some place in the vicinity where the conditions are such as to enable palpalis to be got rid of.

We may be, and probably shall be, unable to prevent sleeping sickness from crossing the frontier into the Sudan, but with care we ought to be able to limit its spread, and at the least to confine the disease to the southern districts of the Bahr-el-Ghazal Province. In order that the precautionary measures outlined above may be properly carried out, it is absolutely necessary that a British Medical Officer of the Medical Corps, Egyptian Army, should be appointed permanently to the southern Bahr-el-Ghazal, and he should be provided liberally with money and tools so that he may be enabled to hire labourers to carry out any work which the Sudan Sleeping Sickness Commission may consider necessary, efficiently and independently.

The question of appointing a Medical Officer for this duty is, I am aware, one that is entirely outside my province, but I beg to repeat that I consider the appointment to be absolutely necessary, especially when the fact that this part of the Sudan is now threatened with what is one of the most fatal of all African diseases is taken into consideration.

Any expenditure on precautionary measures may be objected to on the grounds that the Commission has so far failed to prove the presence of sleeping sickness among the natives in the Bahr-el-Ghazal, and that on this account precautions should be postponed until the disease is actually known to exist. The investigations of the Sudan Sleeping Sickness Commission have undoubtedly shown that there is every reason to anticipate an outbreak of this disease in the Bahr-el-Ghazal, and on this account it is certainly most important that the Sudan Government should act in accordance with the well-known proverb that "forewarned is forearmed." It will be found an immense help, in the only too probable event of an epidemic of sleeping sickness making its appearance in the Bahr-el-Ghazal, to have a system of precautionary measures already in existence, and the establishment of such a system with as little delay as possible may result in the saving of thousands of lives in the future.

SCARLET FEVER AND "FOURTH DISEASE."

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An epidemic resembling scarlet fever occurred among the 2nd Hampshire Regiment at Naval Hill, Bloemfontein, during the year 1908. As this epidemic presented some unusual symptoms I wish to discuss it briefly in relation to the so-called "fourth disease."

In the *Lancet*, July, 1900, Dr. Clement Dukes reported the outbreak of an epidemic in a public school, which he termed provisonally the "fourth disease." According to Dr. Dukes this disease has these characters: It is infectious; the first symptom may be the rash, the eruption being scarlatiniform in type, and covering the entire body in a few hours. The incubation period is nine to twenty-one days. The fauces are red and swollen, and the conjunctivæ pink and suffused. Pre-eruptive vomiting is usually absent. The lymphatic glands are universally enlarged, more especially the posterior cervical, axillary and inguinal. There is usually desquamation which does not bear any relation to the intensity of infection. The kidneys are seldom affected, and in many cases the patient does not really feel ill. The tongue is clean or furred, but does not peel as in scarlet fever. The pulse is not greatly quickened. The temperature ranges from 98° to 104° F. The course of the illness is run in a few days, and an attack does not protect against scarlet fever or rubella.

This paper was subjected to the keenest criticism at the time, and Dr. Dukes had on his side many distinguished observers. Some of his opponents, though not denying the possibility of a "fourth disease," held that its existence had not been proved, and maintained that some of his cases might have been rubella, and others a mild form of scarlet fever. It is a well recognised fact that scarlet fever in various epidemics exhibits different types.

I do not intend to discuss rubella in relation to this epidemic, though it is well known that rubella occurs in two types—the morbilliform, the usual type, and the scarlatiniform. The cases I propose to describe were seen by five or six medical officers, and all were agreed that the disease was not rubella, and indeed the high temperature range of over 104° F. in some of the cases, together with the free desquamation and presence of complications such as albuminuria, are sufficient evidence that the epidemic was not rubella.

The question then arises, Whether scarlet fever may be so modified by climates or other causes as to present symptoms indistinguishable from Dukes' "fourth disease"?

The ordinary mild type of scarlet fever presents the following features: The incubation is short, usually less than six days, and generally two or three days. Foord Caiger[1] states, "I have never met with an instance in which there was any valid reason to believe that the incubation had been longer than six days." This is a point I desire to lay emphasis on in connection with the cases to be described. The onset is usually sudden; in addition to the ordinary febrile symptoms there are three pre-eruptive symptoms which are more or less characteristic of scarlet fever—*i.e.*, sore throat, headache and vomiting. Out of 1,008 consecutive cases Foord Caiger found that vomiting occurred in no less than 80 per cent. The eruption usually appears on the first or second day of illness, and the pulse increases in frequency and the temperature reaches its maximum height about fourth day, after which defervesence sets in, the eruption fades, and the temperature generally reaches the normal by the end of first week.

As regards the chief symptoms: The face is generally flushed, and the region around the mouth is not invaded but is quite pale, in contrast to the flushed cheek; this circumoral pallor is an aid to diagnosis, more especially from measles. The rash usually appears on first day, and is fully developed by the fourth day; it is of a brick-red colour and consists of a punctate appearance, with, in addition, a general blush of erythema. The temperature rises rapidly with the onset, usually reaching 102° to 104° F. on the fourth day in mild cases, with subsequent gradual decline. A rapid pulse is quite characteristic of scarlet fever, more especially during the first or second day of illness. Desquamation is usually in proportion to the extent and severity of the eruption, large flakes usually peeling from hands and feet. The tongue at first is coated, but usually about the fourth day it becomes stripped of its epithelium and resembles a red strawberry; this symptom is quite characteristic of scarlet fever.

In the epidemic, which was described as scarlet fever, occurring among the 2nd Hampshire Regiment at Naval Hill, the first case reported sick on April 28th, 1908, and the last case on August 13th 1908; altogether 33 cases (including 1 death) occurred among the N.C.O.'s and men, and 3 cases among the children. The peculiar features of this epidemic were: (1) The comparative mildness of

[1] Allbutt's "System of Medicine," vol. ii., 1902.

the disease, several of the cases having a normal temperature throughout. (2) The absence of pre-eruptive symptoms—*i.e.*, vomiting and headache—in almost all the cases. (3) The unusually low pulse rate observed in all cases. (4) The character and distribution of the eruption. (5) The character of the tongue. (6) The lengthened period of incubation (average fifteen days). (7) The universal enlargement of the posterior cervical and inguinal glands.

As regards the comparative mildness of the disease, I find on analysis of the 36 cases that in 4 cases the temperature remained normal or sub-normal throughout, though the cases were under observation from the first day of illness; in 2 other cases the maximum temperature recorded was 99° F., while in 14 cases it was 100° and in 24 cases 102° F.; in only 12 cases was a temperature of over 102° F. recorded, but in 8 of these the temperature reached 104° F. or over. As regards the duration of the fever, in 17 of the cases the temperature became normal on first or second day of illness, and in 26 cases the temperature fell to normal by end of third day; only 10 of the cases exhibited a temperature for more than three days, and with one exception the temperature in all cases reached normal by end of sixth day. As during the epidemic the regiment was medically inspected once or twice daily, it may be taken for granted that practically all cases were under observation from first day of illness.

As regards absence of pre-eruptive symptoms, *i.e.*, vomiting and headache, a careful record was kept of all cases, and in only three was there a history of vomiting or headache, though in a few other cases headache was complained of after the appearance of the eruption.

I would particularly point out the marked slowness of the pulse in all the cases, even in cases where the temperature reached 104° F. or over. This is in marked contrast to what is usually noted in scarlet fever, where undue rapidity of the pulse-rate is generally noted, and, indeed, is often an aid to diagnosis. In four of the cases the pulse-rate did not at any time exceed 72.

In 18 cases the highest pulse rate recorded was 80 or under, while in 17 of the cases the highest was 90, and in only 2 cases did the pulse-rate exceed a 100.

As regards the appearance of the eruption, in many cases the rash was the first sign of illness, and in only a few cases was the rash delayed to the second or third day. As a rule the eruption appeared first on the sides of the neck and chest, extending to the abdomen and thighs, being particularly well-marked in the groins.

The rash was scarlatiniform, brick red, erythematous, somewhat punctate, but inclining to leave white patches of skin here and there. In many of the cases no rash could be observed on the arms and legs, and no definite rash could be detected on the face, which was flushed, but in these cases there was a marked absence of the circumoral pallor, so frequently observed in scarlet fever. Desquamation was observed in practically all the cases, and generally of a mealy type on the trunk but somewhat flaky on the hands and feet, and in some cases was not completed until the sixth week.

In some cases the tongue presented a normal appearance throughout the disease; in the majority, however, the tongue was coated but did not peel as in scarlet fever, and in only 4 of the cases was the typical strawberry tongue of scarlet fever noted.

In the first 6 cases enlargement of the glands was not looked for, but in the remaining 30 the posterior cervical and inguinal glands were distinctly enlarged, but tenderness was not complained of except in the case of a child, where the posterior cervical glands were distinctly enlarged and painful the day previous to appearance of the eruption.

A point to be particularly noted in connection with this epidemic was the lengthened period of incubation—seven to twenty-eight days—determined in individual cases where previous contact could be proved, as well as from the intervals between the occurrence of cases in the same barrack-rooms. I may mention that during part of the epidemic period the regiment was under canvas, but as each company was kept distinct they may be regarded as occupying their Company barrack-rooms, more especially as during this period the different companies did not mix but carried out their company training separately. I only give particulars of the incubation period observed during the first three months of the epidemic, as towards the end battalion training was carried out, and consequently it was difficult to prove contact. On the occurrence of a case in barracks, the room, kit, and bedding were disinfected in accordance with regulations (Army Medical Service), all blankets being washed in cresol solution. As bearing on this lengthened period of incubation the following points are of interest: On April 7th an additional blanket was issued to each man in the regiment; these blankets (to be afterwards remarked on) were probably infected and the origin of the epidemic; on April 28th the first 2 cases occurred, both from different barrack-rooms, and within a week 5 more cases were noted also from separate barrack-rooms. Six Companies furnished 2 or more cases, and the number

of days interval between the cases was found to be as follows (disinfection being carried out after occurrence of each case) :—

A	Company.	Number of cases,	2.	Days interval,	24.
B	,,	,,	3.	,,	5, 4.
D	,,	,,	5.	,,	20, 13, 5, 14.
E	,,	,,	2.	,,	7.
G	,,	,,	4.	,,	10, 3, 11.
H	,,	,,	5.	,,	19, 9, 17, 9.

The average incubation period was twelve days.

During this period six barrack-rooms furnished two or more cases, and the average interval between the occurrence of cases was found to be fifteen days, corresponding very closely with the company outbreaks.

No. 4	Barrack-room.	Number of cases,	4.	Days interval,	13, 13, 6.
,, 10	,,	,,	3.	,,	20, 16.
,, 12	,,	,,	2.	,,	23.
,, 13	,,	,,	2.	,,	5.
,, 16	,,	,,	2.	,,	11.
,, 23	,,	,,	2.	,,	27.

This lengthened period of incubation was also observed in individual cases, where previous contact could be definitely proved; but the following examples will suffice :—

(1) Three men occupied same tent from May 9th, 1908. No. 1, Private I., developed scarlet fever on May 17th, 1908, and was isolated in hospital the same day; the two contacts were isolated after disinfection of tent, kits, &c. The isolation was thorough, the men being struck-off duties and not allowed to mix with the regiment. No. 2, Lance-Corporal B., contracted scarlet fever on June 1st, 1908, so that the incubation period in this case must have been sixteen days. No. 3 did not contract the disease.

(2) Towards end of epidemic two members of the same family contracted the disease. D. B., aged 3, sickened with scarlet fever on July 24th, 1908; up to this date she occupied the same bed with her elder sister, L. B. The case was isolated, and on August 8th, 1908, L. B., aged 4, developed symptoms of scarlet fever, so that it would appear as if the incubation period in this case must have also been sixteen days.

The following are examples of the cases observed during the epidemic :—

Case 1.—Private J. April 28th: sore throat, red punctate rash on trunk and limbs, none on face; no prodromal headache or vomiting; temperature, morning, 97·6° F., pulse 66; evening, 99° F., pulse 72. April 29th: temperature, 98·8° F., pulse 66; evening, normal; furred tongue. April 30th: temperature normal, rash faded. Subsequent desquamation.

Case 2.—Private N. May 15th: no prodromal vomiting; red punctate rash on chest and abdomen; coated tongue; sore throat; enlarged

posterior cervical glands; temperature, morning, 98·6° F., pulse 72; evening 99° F., pulse 74. May 16th: rash more marked and extending to limbs; temperature, morning, 98·2° F., pulse 74; evening, 98·4° F., pulse 74. May 17th: rash still marked; tongue normal; temperature, morning, 99° F., pulse 72; evening, 99·2° F., pulse 72. May 18th: rash fading; normal temperature. Subsequently desquamated.

Case 3.—Private H. June 15th: tonsillitis; no history of vomiting; enlarged posterior cervical glands and inguinal glands; red punctate rash on chest and abdomen, none on limbs or face; temperature, morning, 100° F., pulse 78; evening, 104·4° F., pulse 104. June 16th: rash extended to limbs and "blotchy" in parts; throat better; temperature, morning, 103° F., pulse 104; evening, 103° F., pulse 104. June 17th: temperature, morning, 98·4° F., pulse 68; evening, 101° F., pulse 84. June 18th: rash fading; temperature, morning, 99° F., pulse 72; evening, 100° F., pulse 80. June 19th: temperature, morning and evening, 99° F, afterwards normal; subsequent general peeling.

Case 4.—Private G. June 11th: sore throat; furred tongue; headache; temperature, morning, 101·8° F., pulse 76; evening, 101·6° F., pulse 76. June 12th: faint red rash noticed this evening on upper part of chest and neck: temperature, morning, 103° F., pulse 78; temperature, evening, 103·4° F., pulse 78. June 13th: red punctate rash well marked on trunk and extremities; throat better; enlarged posterior cervical glands; temperature, morning, 102° F., pulse 76; evening 102·6° F., pulse 78. June 14th: rash fading; tongue peeled—typical strawberry tongue; temperature, morning, 101·6° F., pulse 74; evening, 101·2° F., pulse 74. June 15th: temperature, morning, 99·4° F.; evening, 99° F. June 16th: normal temperature with commencing desquamation, which subsequently became general.

Case 5.—Private T. June 16th: sore throat; normal temperature; no vomiting; no rash. June 17th: red punctate rash on trunk and extremities; furred tongue; temperature, morning, 98·6° F., pulse 66; evening, 98·6° F., pulse 66. June 18th: rash well marked; temperature, morning and evening, normal; pulse 68. June 19th: rash fading; tongue clean; normal temperature. Subsequent general desquamation.

Complications: Of the 36 cases, 5 had albuminuria, and 3 developed otorrhœa. As regards the origin of the epidemic, the following particulars are of interest:—

Milk could be excluded, as condensed milk is used in barracks. A few cases were returned as scarlet fever among the civil population in Bloemfontein (two miles distant) previous to the outbreak at Naval Hill, but careful investigation failed to prove any contact with them. It was known that the regiment was free from scarlet fever up to the middle of April, as for various reasons it was under medical observation, and no signs of any infectious disease were

noted. I consider that the epidemic originated by means of infected fomities—*i.e.*, blankets, and that this was the origin will, I think, be apparent on perusal of the following :—

(1) On April 7th, six Companies were issued an extra blanket per man (these blankets were partially worn and had been returned from outlying stations to ordnance store, but beyond the fact that they had been in store for one or two years, further information could not be obtained). On the same date the remaining Company (C Company) was issued perfectly new blankets from local barrack-store (this was the only Company which received unused blankets). On April 28th, *i.e.*, twenty-one days after the issue of those blankets, two cases of scarlet fever reported sick, both from separate barrack-rooms, and within a week four more cases were detected, also from different barrack-rooms ; therefore, the infection was widespread.

(2) The incubation period of twenty days also agrees with the lengthened period of incubation observed from cases during the epidemic.

(3) Seventeen of the occupied barrack-rooms furnished one or more cases ; the remaining five occupied barracks-rooms which did not furnish any cases, were occupied as follows : one room by the band, one room by transport, and the remaining three rooms by C Company ; furthermore, all Companies, with the exception of C Company, furnished three or more cases. As regards C Company one case only occurred (the last case of the epidemic), and in this case the diagnosis was doubtful, as beyond a slight erythematous rash the case presented no symptoms and the temperature was normal throughout. Even if the diagnosis was correct in this case, the fact remains that C Company, occupying three barrack-rooms, furnished only one case, and this the last of the epidemic. As regards the band room not furnishing a case, it may be due to the fact that in this barrack-room all blankets and bedding were exchanged on June 5th, this being the only room in which bedding was changed during the period of the epidemic.

(4) Only three children among the married families contracted the disease, and this towards the termination of the epidemic, the infection being traced to indirect contact in one case, and in the remaining two cases to direct contact with the first. A point to be noted in connection with this is that the married families were not issued with extra winter blankets.

(5) The only other barrack-room in the Hampshire lines is occupied by a detachment of the Royal Engineers. This detachment

did not receive the extra blanket (winter issue) and did not furnish a case of scarlet fever.

(6) A second thorough disinfection of blankets and bedding was carried out in July, all blankets (about 4,000) being soaked in cresol solution, and from this date only one case occurred; this, I consider, lends additional support to infected blankets being the cause of the outbreak.

Preventive methods: On the suggestion of the Principal Medical Officer, South Africa, I add a few notes on the measures taken to stamp out the epidemic. Owing to the widespread nature of the epidemic, and partly also to the mild type of some of the cases, it was found particularly difficult to stamp out the disease, more especially as it was some time after the epidemic had well started that I was in a position to trace its origin to the issue of infected blankets.

Of twenty-two barrack-rooms occupied by the 2nd Hampshire Regiment, seventeen rooms furnished one or more cases, and taking this into consideration I consider the regiment fortunate in escaping with 33 cases, more especially as regimental training was practically not interfered with.

The origin being widespread, it was found that prompt isolation and disinfection on the occurrence of a case, though undoubtedly preventing the development of cases in the same barrack-rooms, yet were not sufficient, as cases continued to occur in other barrack-rooms, and consequently more active measures had to be carried out. Previous to this outbreak sore throat was somewhat prevalent, and this may have acted as a predisposing factor to the occurrence of scarlet fever or a similar disease.

The first two cases occurred on April 28th, 1908, both from different barrack-rooms. The cases were immediately isolated in hospital, the patients' kits and bedding were passed through the Thresh disinfector; all contacts were isolated and kept under medical observation, and all their bedding, &c., were exposed to the sun daily.

The third case reported sick May 1st, from a different barrack-room. On the occurrence of this case the bedding and kits of the barrack-room were disinfected, and recognising that the disease might be widespread, medical inspection of the regiment was carried out daily, and as a result one case was detected on May 3rd, and two more on the following day; so that on May 4th six cases from five separate barrack-rooms were in hospital diagnosed as scarlet fever, and therefore 150 N.C.O.'s and men

were contacts. For this reason and also owing to the large number of married families occupying quarters near barracks, it was considered advisable to remove all contacts from barracks and place them under canvas, so as to enable the infected rooms and bedding to be thoroughly disinfected. A camp was pitched the same day and the contacts were moved the same afternoon.

Fresh blankets were supplied for use in the camp and all personal kits were disinfected in the Thresh machine. Subsequently the vacated rooms were disinfected, all woodwork and floors were scrubbed with cresol solution, and walls and ceilings were freely sprayed with formalin. For this purpose an American spray was purchased which was found to work admirably. All blankets in infected rooms were soaked in cresol solution and afterwards exposed all day to the sun; bedding and kits were also passed through the Thresh disinfector. The contacts were kept isolated in camp but carried out their military training.

Within a few days three more cases occurred in barracks; as these also came from different barrack-rooms the remaining men of the battalion were ordered into camp, and the following recommendations approved by the Senior Medical Officer were forwarded to the Officer Commanding.

(1) The regiment is to be placed under canvas on a site selected, and sufficient bell tents are to be provided to accommodate three men per tent, so as to give adequate air space and thus lessen the spread of the disease.

(2) Fresh blankets are to be drawn for use in camp. All bedding, &c., in barrack-rooms are to remain therein until disinfected under medical arrangement.

(3) Three separate camps are to be formed so as to enable contacts from infected barrack-rooms, non-contacts and the draft to be more efficiently isolated.

(4) All officers, N.C.O.'s, and men are to be medically inspected daily.

During the period the troops were under canvas all barrack-rooms, bedding, &c., were disinfected in accordance with regulations (Army Medical Service).

Cases continued to occur in camp, but this was due to the disease having been contracted before going under canvas. The proceedings adopted on the occurrence of a case in camp were briefly as follows: The patient was isolated in hospital; the kits and bedding of the patient and the two contacts who occupied the tent were passed through a Thresh disinfector, the tent was struck,

freely sprayed with formalin and exposed all day to the sun. The contacts were isolated and kept under medical observation for fourteen days. This was effectual as only one contact case subsequently developed the disease while in camp.

On May 24th the Officer Commanding was informed that the troops might return to barracks, the last case having occurred on 15th instant ; but for military reasons the troops remained under canvas for some days longer.

While troops were isolated under canvas the same measures of disinfection were carried out in vacated barrack-rooms as previously described, special attention being paid to the men's reading-room, all papers and magazines being burned, so that as far as practicable the barracks should have been free from infection when the regiment returned from camp; yet notwithstanding all these precautions, when the barracks were again occupied, cases again began to occur (after an interval of twelve days). This may, I think, be accounted for owing to the insufficient period of quarantine (eight days), as the incubation period in this epidemic was found to be from seven to twenty-eight days; and also, as over 3,000 blankets had to be disinfected, in addition to kits and bedding, it may be possible that some were overlooked.

In July cases again became frequent, and it seemed as if the epidemic would again become widespread. With the permission of the Senior Medical Officer, I again started disinfection of barracks. Three barrack-rooms were disinfected daily, the floors and woodwork being again scrubbed with cresol and the walls with formalin, all kits and bedding were disinfected in accordance with regulations, and all blankets in barracks were washed in cresol under regimental arrangements, and reliable N.C.O.'s were told off to see that none were omitted. These measures were entirely successful as from the date this disinfection was carried out, only one case occurred. During the period of the epidemic, Major Buist, R.A.M.C., Specialist Sanitary Officer, visited Naval Hill in reference to this epidemic and reported that the precautions taken were thorough and comprehensive.

Conclusion.—Though the epidemic resembled scarlet fever in many particulars, and the cases were so diagnosed, yet few, if any, of the cases were typical, and this was observed from the beginning. Taking the epidemic as a whole the cases from a clinical aspect corresponded with the so-called " Fourth Disease." Want of space prevents my detailing the clinical records of more of the cases. The epidemic, owing to its peculiar features, is of sufficient interest to be briefly recorded.

VACCINATION.

By Captain H. B. G. WALTON.
Royal Army Medical Corps.

During 1907 I vaccinated 855 recruits at the Depôt, King s Own Yorkshire Light Infantry and York and Lancaster Regiment, Pontefract, with varying degrees of success. At first many results were very disappointing, and men attended for weeks suffering from very bad arms. Septic infection being probably the cause of most of the trouble, I treated vaccination as a serious operation, and the results have been so satisfactory that the details of my procedure may be of interest to other officers. At first I had some difficulty in arranging the work of each orderly, but now that this has been settled the vaccination-parade passes off without a hitch. The duties of each orderly are arranged as follows: No. 1 cleans the part with soap and water and a nail-brush, No. 2 shaves it, and No. 3 cleans it with turpentine, alcohol, and a lotion of hydrarg. perchlor., 1 in 2,000. The part is then dried with sterilised wool and the recruit is passed on to me. The operation is then performed. The ends of the vaccine tube are broken off and the contents blown on to the part with a sterile rubber teat. The usual vaccinating instruments are used, but they are boiled before the operations are commenced, and after each vaccination I heat the instrument in a flame and cool it in 1 in 20 carbolic acid. The patient is then passed on to the man who applies the dressing. This consists of a piece of cyanide gauze and wool large enough to cover the vaccination; the dressing is kept on either by strapping or a piece of bandage. The patients are warned that if the dressing comes off they are to come up at once and have another applied. The results have been perfect in over 685 out of 855 vaccinations, and the attendances have been reduced to a minimum.

During a recent correspondence in the Journal of the Royal Army Medical Corps I noticed that one medical officer remarked that he thought the failures in vaccination were due to the use of antiseptics. I believe that if the point of the knife is used and blood is drawn during the operation the antiseptics will probably destroy the attenuated organisms in the lymph. To this I attribute three of my failures and I now never use the point of the knife to scarify the skin. The serrated end of the instrument in the vaccination case is all that is necessary, and blood is seldom drawn. The process of

cleaning the arm causes an increased flow of blood to the part; the result is that the lymph is rapidly absorbed, and the application of an antiseptic dressing prevents the entrance of septic organisms but does not destroy the virus in the lymph. Every Monday morning vaccinations are performed, and those who were vaccinated on the previous Monday are inspected. A man seldom reports sick before the seventh day and one or two out of each batch usually attend for a few days. When the arm swells and becomes œdematous, the scabs are removed, and the arm is thoroughly disinfected with 1 in 3,000 hydrarg. perchlor., a dressing soaked in the same lotion being applied. This form of dressing is far more useful than boric fomentations, which are practically useless. Every case inspected has a perchloride dressing applied, which is kept on for about two weeks.

The best place to vaccinate is the outer side of the left forearm, about 2 inches below the elbow. One of the advantages of this part of the anatomy is that the dressing can easily be retained in position by a small piece of bandage, one turn being crossed above the flexed elbow. Bandages should always be used in preference to strapping. I have tried the other recognised vaccination areas, but find the part above referred to the best for the recruit. Another advantage is that a man can drill quite well if he is allowed to steady his arm by holding on to his tunic; and this is only necessary from about the fourth to the eighth day. We always have one of these "Nelson's Brigades," as they are called, on the barrack-square. Should an arm become septic, one day's soaking in perchloride, 1 in 10,000, or carbolic, 1 in 60, is usually sufficient to subdue the inflammation, and after attending morning and evening for a few days the patient returns to duty. Vaccination is considered "perfect" when there is a well-marked crop of vesicles; "modified" when a few vesicles appear; "negative," when there are no vesicles.

I find that a fair, auburn-haired individual takes vaccination very badly, and whenever I vaccinate a very fair man, I know that he will attend for three or four days. This particular type of individual seems to be very susceptible, and this is probably due to his skin being very delicate, the virus during the operation penetrating into the subcutaneous tissues.

I have roughly—that is, with the apparatus at my disposal—gone into the bacteriology of the septic arm after vaccination, and find the most common organisms are *Staphylococcus pyogenes citreus* and *aureus*. About the fifth or sixth day the vaccination itches

very considerably, and the temptation to remove the dressing and scratch the part is very great. Most of the men obey the instructions given them, but a few do not, and these attend with septic arms, having inoculated the part with septic finger-nails. The point I wish to bring out is the fact that the swollen œdematous arm, so often seen after vaccination, is not due to vaccination *per se*, but to septic infection; and if this can be guarded against by thorough asepsis, the vaccinator may feel confident that no time in the training of the recruit will be lost through vaccination.

Vaccinations	Number	Result
Primary vaccinations	35	Perfect.
Re-vaccinations	645	,,
,, ...	170	Modified.
,, ...	5	Failure.
Total ..	855	

The five failures were recently vaccinated.

MALTA FEVER AND SIMPLE CONTINUED FEVER: THE SERUM REACTION AND RETROSPECTIVE DIAGNOSIS.

By Major J. G. McNAUGHT.
Royal Army Medical Corps.

The recent arrival of the 1st King's Own Yorkshire Light Infantry at Wynberg, Cape Colony, gave me an opportunity of studying the serum reactions in the cases of a number of men who had previously served in the Mediterranean, and whose medical history sheets contained entries for simple continued fever. I had previously found in the case of a few individuals with a history of Malta fever years ago, that the serum reaction was very persistent, giving quite definite positive results in some cases eight or nine years afterwards. On going through the medical history sheets of the 1st King's Own Yorkshire Light Infantry, I found twenty men had entries for Malta fever and simple continued fever, contracted in the Mediterranean; fourteen of these volunteered to have their blood examined. The number of cases is small, but the results are so interesting that I think it worth while putting them on record, especially as the practical extinction of Malta fever among our troops in the last two years will deprive us of the opportunity of making more extensive investigations. The fact that with the practical disappearance of Malta fever among our garrison in Malta simple continued fever has greatly diminished, supports the belief that a large proportion of cases returned as simple continued fever were really mild cases of Malta fever. Many of these cases, however, give negative results on applying the agglutination reaction, and in the absence of the reaction can only be diagnosed later, on the occurrence of some of the characteristic sequelæ of Malta fever. It is, however, quite possible that, as is known to occur in mild, atypical cases of enteric fever, no agglutination reaction can be obtained in the early stage of the attack, and if the patient is discharged from hospital after ten days or so, he ceases to be kept under observation. Possibly, if the serum reaction were taken later on, positive results would be more frequently obtained in such cases.

The technique was as follows: The microscopic method was employed. The cultures used had originally been derived from the blood of cases of Malta fever; I obtained them from Dr. Eyre,

of Guy's Hospital. One of the cultures had recently had its virulence raised by being passed through a guinea-pig. The emulsions were made in distilled water from agar cultures three to five days old. A large number of control observations were carried out.

The details of the results are given in the following tables. In recording the agglutination results the signs used have the following significance :—

\+ = Complete agglutination.
± = Nearly complete agglutination.
∓ = Distinct clumping, but clumps small and many cocci still free.
− = No agglutination.

From Table I. it will be seen that out of twelve cases which had been diagnosed as simple continued fever in Malta, six cases gave a positive serum reaction in $\frac{1}{20}$ dilution in half an hour. One of these cases, however (serial No. 3) was in hospital suffering from a fever, since diagnosed as Malta fever, when his serum was examined. In his case it is difficult to say whether his present illness is due to a reinfection or not. During the month before admission to hospital he had been on manœuvres in the Transvaal, north of Pretoria. No history of drinking goat's milk was obtainable. He is still suffering from fever, having had three waves of fever since admission. During the course of the third wave he was dangerously ill with hyperpyrexia, congestion of the lungs, and signs of impending heart failure. During the first three weeks of illness his serum agglutinated *Micrococcus melitensis* up to $\frac{1}{60}$ dilution; now, however, after two months fever the agglutination value has fallen to $\frac{1}{10}$. His serum gives no reaction with *Bacillus typhosus* or *B. paratyphosus B.*

Case 8 is of interest, as his serum gives good reactions for both Malta fever and enteric fever. He volunteered the statement that he thought the illness he suffered from in Pretoria must have been Malta fever, as his symptoms were similar to those he had heard his comrades in Malta, who had suffered from Malta fever, describe. The entry on his medical history sheet for enteric fever states that the attack was not severe but protracted. Possibly, the course of his illness was modified by his previously having had fever in Malta.

Case 10 had an entry for Malta fever on his medical history sheet, but as no remarks had been entered it is impossible to say whether the grounds for diagnosis were definite or not. According to his own account he had none of the distinctive symptoms of

Malta fever, and he has had no sequelæ. As his serum gives a good reaction with *B. typhosus*, and he has never been inoculated against enteric fever, it is probable that the fever he had in Malta was really enteric fever.

Case 9 was the only one in which any information as to the results of the application of the serum reaction in connection with attacks of fever in Malta could be obtained from the medical history sheets.

In Case 14 the serum reaction and the history of persistent rheumatism, subsequent to an attack of fever in Crete, are strongly in favour of the patient having had Malta fever, though the illness in Crete is entered as ague in his medical history sheet.

The medical history in Case 15 is suggestive of Malta fever, though the serum now only gives an imperfect reaction in $\frac{1}{20}$ dilution in one hour. To sum up, out of fourteen cases with a history of "fever" contracted in the Mediterranean, but not diagnosed Malta fever, seven cases give a well-marked reaction for Malta fever, and three cases give a slight reaction.

Cases 1, 2, and 12 show that the property of agglutination may persist for a very long time; in Case 12 the original attack occurred thirteen years ago.

None of the control cases, other than the two actually suffering from recent infections of Malta fever, gave any reaction in $\frac{1}{20}$ dilution in half an hour, but two cases (Nos. 8 and 9, Table II.) gave a reaction in $\frac{1}{20}$ dilution in one hour. In neither case could the possibility of a previous attack of mild Malta fever be entirely eliminated.

TABLE I.—Cases of Malta Fever and Simple Continued Fever.

Serial No.	No.	Rank	Name	Previous medical history	Serum reaction from Malta fever				Remarks
					$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{80}$	Time	
1	—	Staff-Serjt.	R.	M.H.S. shows an entry for simple continued fever in Malta in 1898	+	+	+	$\frac{1}{2}$ hour	At time of examination was in hospital with synovitis of knee.
2	—	Major ..	M., R.A.M.C.	Had Malta fever ten years ago in Malta	+	+	±	,,	—
3	6709	Private ..	A., 1st K O.Y.L.I.	M.H.S. shows entries for simple continued fever in Malta in 1903 and in Crete in 1904	+	+	+	,,	At time of examination was in hospital suffering from Malta fever.
4	6942	Private ..	Mg., 1st K.O.Y.L.I.	M.H.S. shows entry for simple continued fever (6 days) in Malta in 1903; no sequelæ	−	−	−	,,	No reaction at end of 1 hour.
5	6262	Private ..	C., 1st K.O.Y.L.I.	M.H.S. shows entries for simple continued fever (14 days) in Malta in 1904, and rheumatism (20 days) in Gibraltar in 1905	+	−	−	,,	He says he was ill with rheumatism for three months while on furlough from Gibraltar.
6	7079	Private ..	P. K., 1st K.O.Y.L.I.	M.H.S. shows entries for synovitis in Malta in 1904 and 1905; influenza with intestinal symptoms in Gibraltar in 1907	+	∓	−	,,	Reacted well in $\frac{1}{80}$ dilution in 1 hour. He states he had Malta fever in 1901 while in the Militia.
7	6811	Private ..	Hy., 1st K.O.Y.L.I.	M.H.S. shows entry for simple continued fever in Malta in 1903	∓	−	−	,,	Gave a complete reaction in $\frac{1}{20}$ dilution in 1 hour, and an incomplete reaction in $\frac{1}{40}$ dilution.
8	6724	Private ..	I., 1st K.O.Y.L.I.	M.H.S. shows two entries for simple continued fever in Malta in 1903, and an entry for enteric fever at Pretoria in 1906. ("Moderate; several slight relapses"; 118 days in hospital)	+	±	−	,,	Serum gave a positive reaction with *B. typhosus* in $\frac{1}{20}$ and $\frac{1}{40}$ dilution in 1 hour.
9	6762	Private ..	B., 1st K.O.Y.L.I.	M.H.S. shows an entry for dyspepsia with slight pyrexia in Malta in 1904; serum then negative for Malta fever	−	−	−	,,	No reaction in 1 hour.

					$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{60}$	Time	
10	6955	Private ..	W., 1st K.O.Y.L.I.	M.H.S. shows an entry for Malta fever in Malta in 1904; no sequelæ; in hospital 49 days	—	—	—	$\frac{1}{2}$ hour	The entry for Malta fever in M.H.S. has no entry in column for remarks, and is not signed by any medical officer. His serum now gives a positive reaction with *B. typhosus* in $\frac{1}{40}$ and $\frac{1}{60}$ dilution. He has never been inoculated against enteric fever.
11	—	Major ..	S., Royal Engineers	Had malta fever in 1904-1905 in Malta	+	—	—	,,	Attack very severe; several relapses.
12	—	Lieut. and Qr.-master	B., A.S.C.	Had Malta fever in Malta in 1895..	+	—	—	,,	Attack severe; relapses.
13	9096	Corporal ..	L., 1st K.O.Y.L.I.	M.H.S. shows entries for simple continued fever in Malta in 1898 and 1901; no sequelæ	—	—	—	,,	No reaction in 1 hour.
14	6105	Corporal ..	H., 1st K.O.Y.L.I.	Entry in M.H.S. for ague (9 days) in Crete in 1905; rheumatism (65 days), 1907, in Pretoria; attack "mild, but relapsing"	+	—	—	,,	Serum gives imperfect reaction in $\frac{1}{40}$ dilution in 1 hour.
15	5429	Corporal ..	Ls., 1st K.O.Y.L.I.	M.H.S. shows an entry for simple continued fever (9 days) in Malta in 1903, an entry for influenza with enteric (?) in Malta in 1905, and two entries for rheumatism in 1905	—	—	—	,,	Serum gives an imperfect reaction in $\frac{1}{20}$ dilution in 1 hour.
16	6804	Corporal ..	H., 1st K.O.Y.L.I.	M.H.S. shows an entry for simple continued fever in Malta in 1903, and entries for debility, bronchial catarrh, and hæmorrhage from lungs in 1905, 1906, and 1908. T.B. never found in sputum	—	—	—	,,	Serum gives an imperfect reaction in $\frac{1}{20}$ dilution in 1 hour.
17	6751	Corporal ..	D., 1st K.O.Y.L.I.	M.H.S. shows an entry for simple continued fever (7 days) in Malta in 1903; no sequelæ	—	—	—	,,	No reaction in 1 hour.
18	7011	Corporal ..	B., 1st K.O.Y.L.I.	M.H.S. shows an entry for simple continued fever in Malta in 1904; was in hospital for 34 days	+	—	—	,,	—

TABLE II.—Control Cases.

Serial No.	No.	Rank	Name	Medical history	Serum reaction for Malta fever				Remarks
					$\frac{1}{20}$	$\frac{1}{40}$	$\frac{1}{60}$	Time	
1	..	Major ..	M.	Has served in Malta, and while there had slight attack of fever, lasting 3 or 4 days ; no sequelæ	−	−	−	$\frac{1}{2}$ hr.	No reaction in 1 hour.
2	..	Mrs. ..	M.	Has never been in Malta	−	−	−	,,	,, ,,
3	..	Boy ..	En.	Suffering from Malta fever, contracted in O.R.C.	+	+	+	,,	A case of Dr. Strachan's, Philippolis, O.R.C. Serum agglutinated up to $\frac{1}{10000}$.
4	..	Private ..	B.	Has never served in Malta	−	−	−	,,	No reaction in 1 hour.
5	..	Private ..	M., 4th D.G.	,, ,, ,, ...	−	−	−	,,	,, ,,
6	..	Mr. ..	L.	Suffering from Malta fever, contracted in O.R.C.	+	±	∓	,,	A case of Dr. Strachan's.
7	..	Staff-Serjt.	P., A.O.D.	Has never been in Malta	−	−	−	,,	No reaction in 1 hour.
8	19278	Private ..	R., R.A.M.C.	Before enlistment had been employed on a steamer sailing to Bombay ; shortly after enlistment was in hospital suffering from rheumatism, anæmia and debility. Has never served in Malta	−	−	−	,,	Gave a good, though not complete, reaction in $\frac{1}{20}$ ilution in 1 hour.
9	..	Major ..	C.	Has never served in Malta. While in India, six years ago, had slight continued fever resembling influenza on several occasions	−	−	−	,,	Gave a good reaction in $\frac{1}{20}$ dilution in 1 hour.
10	..	Mrs. ..	C.	Has never been in Malta except for a few hours on the way to India. Has had enteric fever	−	−	−	,,	No reaction in 1 hour.
11	6569	Bugler ..	B., R.G.A.	Has never served in Malta. No history of any fever resembling Malta fever	−	−	−	,,	No reaction in 1 hour. Suffering from pneumonia when serum was taken.
12	11370	Serjeant ..	L., R.A.M.C.	Has never served in Malta. Had enteric fever in 1901	−	−	−	,,	No reaction in 1 hour.
13	6707	Private ..	S., 1st K.O.Y.L.I.	Has served in Malta, but never had Malta fever or a fever resembling it. M.H.S. shows an entry for tonsillitis in Malta	−	−	−	,,	,, ,,

THE 1908 SLEEPING SICKNESS COMMISSION OF THE ROYAL SOCIETY.

By Colonel Sir DAVID BRUCE, C.B., F.R.S.

This, the third Commission sent out to Uganda since 1902, under the direction of the Royal Society, for the study of sleeping sickness, was formed in 1907, at the suggestion of His Excellency Sir H. Hesketh Bell, K.C.M.G., Governor of Uganda, to the Secretary of State for the Colonies, for the purpose of continuing the investigation and utilising the laboratory built for the Commission in 1906.

The *personnel* of the 1908 Commission is as follows: *Director:* Colonel Sir David Bruce, C.B., F.R.S. *Members:* Captains A. E. Hamerton, D.S.O., and H. R. Bateman, Royal Army Medical Corps, and Captain F. P. Mackie, Indian Medical Service. *Laboratory Assistant:* Sergeant A. Gibbons, Royal Army Medical Corps. *Secretary:* Mr. James Wilson.

The Commission left England on September 16th, 1908, and reached Mombasa, British East Africa, on October 14th. Here the Commission was received, and the rough places made smooth for it, by Mr. Waller, the Coast Agent to the Uganda Protectorate, and Mr. Stanley, the Assistant Traffic Manager to the Uganda Railway. The Commission was also most hospitably entertained by Dr. Hinde, the Acting Commissioner.

After spending two days at Mombasa waiting for a train, a start was made for the Lake. At Nairobi, the Commission met the Principal Medical Officer, Lieutenant-Colonel J. Will, Royal Army Medical Corps, who, unfortunately, was on the point of leaving the country to return to military duty. Here also the Commission received a telegram from His Excellency Sir J. Hayes Sadler, K.C.B., Governor of British East Africa, with the information that he would meet them at Naivasha, higher up the line. At Naivasha the Commission's carriage was attached to the Governor's special train, and proceeded with him to Port Florence. At Nakuru His Excellency Sir H. Hesketh Bell, K.C.M.G., Governor of Uganda, and his staff also joined the train.

From the Governor the Commission heard that sleeping sickness had of late been making sad havoc among the Kavirondo on the eastern shores of the Lake, a large percentage of whom are reported to be infected. This seems to be due to the habit these people

have of fishing, a pastime the Kavirondo people are much addicted to, in the rivers which run into this part of the Lake, where the wooded banks swarm with tsetse-flies.

During the journey up country the Commission had a good view of the snow-capped Kilimanjaro from the Kapiti Plains, and moreover saw on the Athi Plains an enormous number of wild animals, including several giraffe.

On arriving at Entebbe on Monday, October 19th, the Commission was most kindly received by Dr. Hodges, the Principal Medical Officer, Mr. Russell, the Director of Transport, and others of the Uganda officials, who had come down to the landing-place in full canonicals to welcome officially the Governor, who had been for a short shooting excursion into British East Africa.

In Entebbe the Commission remained until Wednesday, October 21st, being most hospitably entertained by the Governor at the new Government House, while others of the members were equally kindly looked after by the Principal Medical Officer.

A great improvement was seen in the Government Cantonment of Entebbe. In 1903, all the houses were thatched with grass, productive of many fires, there were no glass windows except in the then newly built Government House, there was no Club, no golf course, and no means of conveyance into the native capital of Kampala. Now all the roofs are of corrugated iron, all the houses have windows, there is a still newer and more palatial Government House, a first-rate Club, an excellent golf course, and a motor-bus which runs into Kampala daily.

The Commission remained in Kampala for one night, where they have to thank Captain Ireland, King's African Rifles, for his hospitality, and at last reached their destination, Mpumu, on Thursday, October 22nd.

Here they found the Royal Society's laboratory and two good houses built, while another was in course of construction. The laboratory and one of the houses had been brought from the spot on the Lake shore some three miles from Entebbe, where they had been built in 1906. Previous to that the laboratory had been situated in Entebbe. This camp at Mpumu (0° 14′ N. latitude, 32° 50′ E. longitude) is on the top of a flat-topped hill with steep sides, standing some 500 feet above the surrounding country. It is 750 yards long and, roughly, 250 yards broad; its long axis runs in a north-westerly and south-easterly direction. It lies 6 miles from the Lake at its nearest point—Kibanga, on Buka Bay. The surrounding country is very hilly, Mpumu, about 4,300 feet above

sea-level, being on a level with most of the adjacent hills; many of these are wooded, and between the hills the country is swampy.

The Commission shortly after their arrival set up a meteorological station, the instruments being lent by the Botanical, Forestry and Scientific Department, and observations made during November and December show, for the former month a temperature ranging between 59° and 82° F. and for the latter month between 57° and 85° F. Mpumu has, therefore, a temperate and pleasant climate. The rainfall is, of course, high; over 9 inches fell in November, and 5½ inches in December, in spite of the latter being one of the driest months.

Kampala, the native capital, where supplies are obtained, is 27 miles to the west, and headquarters another 22 or 23 miles further on. The position chosen for the camp is, therefore, isolated and difficult of access, which will probably render the work of the Commission more difficult and slower than if a more accessible site had been chosen. In all probability experience will show that a mistake has been made in placing the laboratory in such an isolated place, and it will be found that the laboratory had better have been left on the spot near Entebbe, where it was originally erected. No doubt the difficulty of choosing a suitable site was great, especially if the principle was followed that the camp must be in the vicinity of a sleeping sickness concentration camp as well as the Lake. But the nearest sleeping sickness concentration camp is 7 miles of steep native paths away, and for all practical purposes might be 70.

It may seem ungracious to criticise the site chosen for the purposes of this investigation; but, on the other hand, if the results of the work are less than had been expected, then it is only right and just that the difficulties the Commission have to cope with should be known. Undoubtedly, our isolated position does double or treble our difficulties.

The Laboratory, 45 feet long and 18 feet wide, is built of corrugated iron. It is capable of accommodating six workers, and is excellently adapted for the work. It is well furnished with all the essentials, and has a supply of pure rain water from the roof, collected in two tanks, each of 400 gallons capacity. The rain water collected in the pure atmosphere of Mpumu is equal to *aqua distillata*, and we use it as such. The photograph (fig. 1) shows the laboratory and the office.

Monkey House.—Fig. 2 is the monkey house. This is a large fly-proof shed, 30 feet square. Monkeys are much healthier and

FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

happier in the open air, and as there has been a good number of deaths among the monkeys confined in this house, it is being gradually emptied in favour of open-air boxes. Experience teaches that the common wild monkey in Uganda will live for years in captivity in perfect health if kept in the open air. As it is sometimes necessary to keep experimental monkeys under observation for months, it is evident that all closed-up monkey houses are a delusion and a snare. What can be more annoying than to lose the work of months by an experimental monkey dying of some extraneous malady?

Director's House.—This, as can be seen from fig. 3, is a large house, constructed of corrugated iron.

The Mess.—Fig. 4. This and the other houses erected are the ordinary wattle and daub huts, thatched with grass, which are used in this country by the better class natives. They are cool, comfortable and picturesque, but have one disadvantage, and that is, their liability to be set on fire by lightning. There is, however, little danger of this in the vicinity of iron-roofed houses, as the latter will probably attract the lightning to a much greater extent.

The hill is formed of ironstone, and violent thunderstorms are common. A few days ago a tree was struck within a hundred yards of the Director's house, and torn to ribbons.

The Water Supply.—The natural water supply of Mpumu is a small mud hole some 5 feet in diameter and 1 foot deep, situated at the foot of the hill to the south-east. This is surrounded by native huts and cultivated ground, and as ankylostomiasis is almost universal among the natives of Uganda, there seemed reasonable ground for looking on this water supply as dangerous, even for bathing purposes. Mr. S. Caink, the District Engineer, however, came to the rescue by digging a cistern to hold 3,000 gallons in the ironstone rock. This, like the widow's cruse, has been full and overflowing ever since with beautifully clear and cool water collected from the iron roof of the Director's house. For every inch of rain which falls 1,300 gallons of water run into the cistern, giving a total of 20,000 gallons during the months of November and December, or 46 gallons per head per diem of the white population on the hill. This water supply was gained at small cost and has been an unqualified success.

Conservancy Arrangements.—In order to keep the surroundings of the camp clean, a destructor has been built to burn up the rubbish. This has also been cut out of the ironstone rock, and consists, as will be seen from fig. 5, of a chamber some 5 feet

square, fed from above through a circular opening 16 inches in diameter. The front and roof are made out of sheets of corrugated iron, enclosing a thick layer of clay. The chimney, which is also made of corrugated iron sheeting, is 9 feet high. This is also a success, and all refuse from cook-houses, &c., is brought here and

Fig. 5.

burnt, instead of being thrown away among the long grass, and so causing in time an unsightly nuisance.

Cattle Sheds.—As the Commission is, in addition to sleeping sickness work, trying to find out the nature of the various animal trypanosome diseases of Uganda, as well as an important disease among calves called m'kebe, three separate cattle sheds and cattle

runs have been constructed—one for healthy oxen, another for trypanosome disease, and the third for m'kebe. The trypanosome disease is causing a large number of deaths among the Government transport oxen, as well as among the native cattle, and neither its true nature nor its carrier is as yet known. M'kebe is said to cause a mortality among calves of from 40 to 60 per cent.

Collection of Flies.—As the study of *Glossina palpalis* and its relation to sleeping sickness naturally stands in the front rank as a subject of study by the Commission, it is necessary to have a large supply of tsetse-flies to work with. The Lake shore is 6 miles away, so that it is not possible for the fly-boys to walk up and down every day, and also find time for catching the flies. The six fly-boys therefore live in a hut near the Lake shore at Kibanga, one of the authorised cleared landing places. This landing place on the arrival of the Commission was found to be in a neglected and overgrown condition, and tsetse-flies were quite numerous. As a market is held here once a week, at which some hundreds of natives congregate from Buvuma and other infected islands, to sell earthenware pots and dried fish to the natives on the mainland, the danger of such a state of affairs is unmistakable. This on being pointed out to the Sekibobo was at once remedied, and now not a single tsetse-fly has been caught at Kabanga for a long time. But as a consequence the fly-boys have now to use a canoe to reach a spot where flies can be caught. A suitable place is found a short distance away, and the flies are so numerous along the Lake shore that although the boys catch from two to three hundred flies daily at the same spot, the supply shows no signs of diminishing.

Programme of Work.—Immediately on arriving here a programme of work was made out. The following are some of the items, which will serve to show the lines on which the Commission propose to pursue this investigation :—

Trypanosoma gambiense (*Dutton*).

(1) *Staining.*—For anything save the merest clinical observations, films must be mounted by the moist method.

(2) Study the fate of *T. gambiense* in *Glossina palpalis* fed artificially on infected animals. Examine 200 flies at different stages; repeat this experiment as often as possible with flies reared in the laboratory. Make the same experiment with stomoxys, tabanus, fleas, lice, bugs, *Ornithodorus moubata*, and the Congo floor-maggot.

(3) Mount *T. gambiense* blood as a fresh preparation, mixed with various sera—birds', lizards', goats', &c.—and note how long it retains its motility and apparent vitality.

(4) Attempt the cultivation of *T. gambiense* from blood of infected animals and also from intestinal contents of infected *G. palpalis*.

(5) Is the filtered blood of animals suffering from *T. gambiense* infective?

(6) Repeat experiments made by chopping up *G. palpalis* artificially infected with *T. gambiense*, and then injecting the emulsion into susceptible animals. How long, under these conditions, does *T. gambiense* remain infective?

(7) The examination of animals, domestic and wild, from the sleeping sickness area, to find if any of them act as a reservoir of the virus.

Glossina palpalis.

(1) Examination of the natural *G. palpalis* as to the following points:—
- (*a*) How many naturally infected *G. palpalis* are there?
- (*b*) What percentage are infected with *T. grayi?*
- (*c*) What percentage are infected with *T. tullochii?*
- (*d*) What percentage are infected with both species?
- (*e*) What other parasites can be found in the intestine and organs of *G. palpalis*?
- (*f*) Koch says he can distinguish four species of trypanosomes in *G. palpalis*. How many can the Commission distinguish?
- (*g*) Koch is also of opinion that *T. tullochii* is in reality *T. gambiense*. Does the Commission agree with this?

(2) Biology of *G. palpalis*.
- (*a*) How do these diptera breed?
- (*b*) Where do they lay their pupæ? Where are the breeding places.
- (*c*) How long does the fly live?
- (*d*) How many pupæ does it lay?
- (*e*) Habitat. Why does the fly like water?
- (*f*) Food of the fly.
- (*g*) Enemies of the fly, &c., &c.

Sleeping Sickness.

(1) Why is one species of animal susceptible and another immune? Todd thinks the answer to this will be found in the enlarged glands.

(2) What is the pressure in the cerebro-spinal canal? Some of the symptoms may be due to this.

(3) What is the nature of the auto-agglutination of red cells in trypanosome infection?

(4) What percentage of insane natives are really cases of sleeping sickness?

(5) Puncture all cases of much enlarged glands. Note if any obvious cause of enlargement is present. Todd thinks if chronic sleeping sickness is found to be widely spread, then sleeping sickness epidemics probably represent the spread of more virulent strains. Does this apply to Uganda?

(6) Careful leucocytic counts should be made when opportunity offers.

(7) Study modes of spread of sleeping sickness other than by biting flies: saliva, close contact, &c.

(8) What percentage of early sleeping sickness cases will gland palpation fail to detect?

(9) Duration of disease.

(10) Mortality.

(11) Deaths in Uganda.

(12) Present position of the epidemic in Uganda.

Distribution of Sleeping Sickness and G. palpalis.

(1) Continue the work done in 1903, and since then by Dr. Bagshawe and others, on the distribution of sleeping sickness and *G. palpalis* in Uganda.

(2) Work out and prepare maps showing the distribution in Uganda of other species of *Glossina* and other biting flies, mosquitoes, ticks, &c.

Treatment.

(1) Atoxyl : the results of treatment by this drug. The after-history of Koch's cases should be reported on. Atoxyl alternating with mercury, antimony, or any drug which can be combined with it to advantage.

(2) Antimony salts.

(3) Atoxyl-proof. Is there any proof that this occurs in man ? If so, is this strain more virulent, *e.g.*, for monkeys.

(4) Experiments with new remedies.

(5) Try feeding experiments (*G. palpalis*) or injection experiments with blood from native undergoing atoxyl treatment. Does atoxyl render natives innocuous ?

(6) Is there any evidence that a single case of cure in man has taken place ?

Prevention.

(1) Effects of clearing the Lake shore.

(2) Is it possible to destroy the fly ?

(3) Is it possible to stamp out the disease in Uganda ?

(4) Effect of segregation of sick in sleeping sickness camps.

Miscellaneous Cattle trypanosomes. M'kebe. Monkey malaria. Auchmeromyia luteola. Ticks, &c.

(1) The eggs (length of time to hatch) and larva of *A. luteola* have never been described. The distribution of this fly is fairly universal. Does it transmit ?

Filaria perstans ? (Todd.)

(2) Does monkey malaria blood give rise to the disease if injected ?

(3) Work out, if opportunity offers, the development of monkey malaria.

(4) Find out species of human ticks.

(5) What is the best way to destroy ticks ?

(6) Will mosquitoes transmit spirochætæ ?

(7) Examine spirochætæ-infected animals by day and night for sexual forms. Filtrates of spirochætæ are infective. What is in them ? (Todd.)

(8) Watch nose, larynx and trachea carefully in native *post mortems* for pneumonyssus ; also liver for porocephalus, &c. (Todd.)

(9) A good histological study of lesions in trypanosomiasis is much needed.

(10) Deaths from trypanosomes and spirochætæ often seem to be toxic. Attempts to isolate these toxins have so far failed.

(11) Get early cases of tick fever and determine definitely the duration of the first attack.

(12) A Guinea-worm was found in baboons in the Gambia, but was lost. (Todd.)

(13) Examine a series of monkeys for worms. Determine species and mode of entrance of worm. (Todd.)

(14) Get Glossina and ticks to bite through a celloidin membrane, in order to collect saliva extruded, and so ascertain what the infecting bodies are in sleeping sickness, tick fever, &c. (Todd.)

(15) Do the trypanosomes of the wild animals belong to the type *T. brucei*, *T. dimorphon*, or to other species ?

(16) Work out the nature of the trypanosome disease of cattle in Uganda and find its carrier.

(17) Work out the nature of the m'kebe in calves.

Circular.—In order to arouse the attention and excite the interest of the various officials, missionaries and traders in Uganda, the following circular has been printed and sent round.

SLEEPING SICKNESS COMMISSION OF THE ROYAL SOCIETY, 1908.

(1) This Commission has been sent out to Uganda, at the suggestion of His Excellency Sir H. Hesketh Bell, K.C.M.G., by the Colonial Office, to continue the investigations initiated in 1903.

(2) In 1903 the Commission discovered that sleeping sickness is caused by the entrance into the blood of a minute parasite, the *Trypanosoma gambiense*, and that this trypanosome is conveyed from the sick to the healthy by means of a particular fly, the *Glossina palpalis*, and by it alone.

(3) The distribution of this fly was then worked out and found to coincide exactly with the distribution of sleeping sickness, a strong proof that this fly is the only carrier.

(4) The distribution of this species of tsetse-fly was found to be a peculiar one. It was only found on the shore of the Lake, or on the banks of open rivers, such as the Nile, where there is plenty of forest shade. This rendered it easy for intelligent persons to escape sleeping sickness, as all that was required was to keep out of the fly area, or if it was necessary to pass through it, to take precautions against being bitten by the fly. It also enabled preventive and stamping-out measures to be organised on a rational basis.

(5) The last Sleeping Sickness Commission continued to work until March, 1906, when one of the members, the late Lieutenant Forbes Tulloch, R.A.M.C., most unfortunately contracted the disease, and this sad event brought the work of the Commission to an abrupt close.

(6) It had been the intention of the Royal Society to keep this scientific Commission constantly employed by sending out fresh workers from time to time, until all the main diseases, both of men and animals, had been described and their distribution mapped out. It was truly said to the Commission the other day by Lord Delamere, that it is only by science that these colonies can progress. In the last Report of the Government Veterinary Bacteriologist, Transvaal, it is stated that the sum of money voted by the Legislative Assembly to his department alone for the current expenditure of the year was £30,934. In the Transvaal this money is considered well spent.

(7) If the programme of the Royal Society had been carried out, no doubt much good would have accrued to the Protectorate. Examples

illustrating this could be multiplied: in 1903 when Mr. Grant brought some 1,500 cattle from Mount Elgon to Jinja, he rested them in a valley swarming with *G. morsitans*, and as a result lost them all from nagana. A little knowledge of the distribution of this deadly fly would have prevented this loss. Again, at the present time, the Uganda Government are losing numbers of their oxen from an unknown disease. If the cause of it could be discovered and its mode of spread traced, this mortality among the stock might be prevented. Thanks to the courtesy of the Principal Medical Officer, Dr. Hodges, who thinks the disease may be caused by *T. dimorphon*, and the Transport Officer, Mr. Russell, the Commission are having the opportunity of seeing examples of this disease. Yet, again, the Commission are informed that from 40 to 60 per cent. of calves die of a disease called "m'kebe." This seems a large mortality, and something might perhaps be done to lessen it. The Commission, thanks to the kindness of the Katikiro and the Sekibobo, will also have an opportunity of seeing this disease.

(8) During the last few years the knowledge of the distribution of the *G. palpalis* and of sleeping sickness in Uganda has been much advanced, and mainly through the energy of the Principal Medical Officer, Dr. Hodges, and Dr. Bagshawe, at present Director of the Sleeping Sickness Bureau in London. It is gratifying to know that nothing has been discovered to shake the conclusions arrived at by the Commission in 1903.

(9) The chief work of the present Commission is to continue the study of sleeping sickness in the Protectorate, and for this reason this Memorandum is being sent to officials, missionaries and others, to invite their aid and criticism. At the same time the Commission is ready to undertake the investigation of any disease, whether of men or animals, which may be brought to their attention.

(10) Since 1903 evidence has been brought forward, especially from the Congo, to the effect that sleeping sickness is spread not only through the agency of *G. palpalis*, but also by other species of tsetse-flies, other biting flies, and even by fleas and such-like insects. Now, if anyone can bring forward any proof of cases of sleeping sickness arising in districts free from *G. palpalis* the Commission would be greatly assisted. The theory held by the Commission is that the tsetse-fly, *G. palpalis*, is the only carrier. Naturally, it is most important to know if other biting insects can also act as carriers.

(11) Again, His Excellency, Professor R. Koch, of Berlin, has advanced the theory that close contact, as, for example, when an infected man returns from the sleeping sickness area to his wife and children living in a fly-free area, is also a means of spreading the disease. The importance of this cannot be exaggerated. The Commission hold that this never occurs, but invite information and criticism.

(12) Another important point which is engaging the attention of the Commission is whether it can be shown that any other animal except

man is capable of acting as a reservoir of the virus. The importance of this is self-evident. For example, the monkey is very susceptible to this disease, and dies in a few months after infection. If the monkeys along the Lake shore are infected, then the removal of the Lake-shore population will not render that area healthy, as the *G. palpalis* will be able to get the virus from the monkey. This also holds good of the hippopotamus. The Commission do not believe that this occurs, but wish to examine the blood of as many monkeys and hippopotami as possible. The Commission would like, therefore, to receive as many living monkeys from the Lake shore as possible, especially from places where sleeping sickness is prevalent. Also, is there any evidence that monkeys have been dying of sleeping sickness? It is reported that the monkeys have disappeared from Buvuma. Is this true? In the event of a hippopotamus being killed on land or shallow water, the heart full of blood might be sent post haste to the Mpumu laboratory. The blood-vessels at the base of the heart should be tied lightly, and the heart wrapped in damp grass or banana leaves to keep it cool.

(3) In tropical countries the chief disseminators of disease are blood-sucking insects. For example, malaria is carried by certain mosquitoes, sleeping sickness by a tsetse-fly, the *G. palpalis*, tick fever by a tick, horse sickness probably by a mosquito, East Coast fever and redwater in cattle by ticks, jaundice in dogs by a tick, and so on. It is therefore very important that the different species of these biting insects should be known and their distribution mapped out. Their habits (such as feeding by day or night), their habitat (such as living in houses, valleys, woods or marshes), &c., should also be studied. The Commission would therefore be greatly obliged if anyone interested in these matters would send in specimens of biting flies, mosquitoes, ticks, fleas, &c. All that is necessary is to kill them, and then place them in a bottle, gourd, or matchbox, addressed to the Sleeping Sickness Laboratory, Mpumu, with an enclosure giving the native name, place of capture, &c. All such specimens will be fully acknowledged in the official Reports of the Commission.

Mpumu, Chagwe, Uganda,
December 12th, 1908.

United Services Medical Society.

THERE was a demonstration of cases in the Library of the Royal Army Medical College, Millbank, on February 10th, 1909.

Lieutenant-Colonel C. Birt exhibited two cases of incipient tuberculosis illustrating the use of Calmette's eye-test and v. Pirquet's skin reaction. The ophthalmic test has been employed seventy-eight times at the Queen Alexandra Military Hospital. Twenty-five times the result was positive, fifty-three it was negative. In all the former the diagnosis of tubercle was subsequently otherwise confirmed. The preparation made use of has been "tuberculin-test for ophthalmo-diagnosis" of the Pasteur Institute of Lille. Each capsule contains about $\frac{1}{10}$ cc. of liquid, which, it is stated, is sufficient for two or three trials. Now this dose is much too large, and may lead to severe and protracted reaction. Lieutenant-Colonel Birt finds that the instillation of $\frac{1}{250}$ cc., measured by a capillary pipette, is amply sufficient to induce the reaction in tubercular subjects. In carrying out v. Pirquet's test a drop of Koch's old tuberculin, or of a dilution of it, is placed on the cleansed forearm. The boring motion of a rough and blunt point introduced through the middle of the drop causes a slight abrasion of the skin. The area will become reddened in six to twenty-four hours if tubercle exists. If undiluted tuberculin be applied, a reaction may occur in a proportion of healthy adults, hence the importance of reducing the amount of tuberculin by dilution. To an emulsion of sterilised tubercle bacilli the skin is much less sensitive. In thirty-four trials with the latter a positive reaction has been observed four times only; all were cases of tubercle.

Lieutenant-Colonel Birt exhibited the viscera, microscopical preparations, and a culture of tubercle bacillus from a man who had succumbed to general tuberculosis of the lymphatic glands, which had caused an erroneous diagnosis of "Hodgkin's disease" to be made. Enlargement of the axillary and cervical glands had existed for three years, and had become much aggravated by residence in a hot climate. Nine months before death he began to show signs of a mediastinal growth. He had leucocytosis of 20,000 per c.mm., but no increase in the mononuclear or eosinophile cells. The tubercular infection probably had started in his mesenteric glands. One in a state of calcareous degeneration was found. There was a mass of lymph glands in the abdomen

weighing 500 grammes, and one weighing more than a kilogramme in the thorax. Tubercle bacilli were present in great abundance, and a growth was obtained on glycerinated potato from a cervical gland. The lungs and spleen were infiltrated throughout with miliary tubercles.

Lieutenant-Colonel R. J. S. Simpson showed a case of hepatic abscess in an early stage.

In 1905 Rogers called attention to the slighter degrees of leucocytosis occurring in acute hepatitis (without suppuration) as a sequel to amœbic infection of the bowel, a condition which in one of his cases passed off under administration of ipecacuanha. In his book on fevers in the Tropics, and in the *Philippine Journal of Science*, September, 1908, he described a group of cases from the General Hospital, Calcutta, with chronic fever of an intermittent type, possibly with no definite symptoms of hepatitis, and rarely with any dysentery, but showing a moderate degree of leucocytosis in which the polynuclears were either normal, or not greatly increased, *i.e.*, rarely over 80 per cent. This he believes to be a point of diagnostic value. These were all improved or cured by the treatment with ipecacuanha given in keratin capsules to avoid vomiting.

The following appears to be a case of this type:—

Lance-Corporal Biddulph, an invalid from India, transferred from Netley on January 9th, complaining of pain in both shoulders and epigastrium, with a slight fever.

Previous History.—Soft chancre in January, 1905; the diagnosis was evidently rather doubtful, as a suspicious rash is noted. Malarial fever at Quetta, October, 1907. From May 28th, 1908, at Mohmund, he has been diagnosed inflammation of the liver, which was then enlarged downwards one finger's breadth below the costal margin, but not upwards. At Cherat, in July-August, 1908, the liver was explored for pus, which was not found; abscess of the left border of the right lobe was suspected. Several times he has been reported as "improved." There is no history of dysentery. No history of sweating.

On admission the patient was well nourished, but looked ill; there was some fever. The liver extended from the sixth rib in the nipple line to the costal margin in that line, from which it was palpable in a straight line to the middle line of the body, where the edge curved upwards to the opposite costal margin. The edge and upper surface were smooth and tender on pressure. The liver moved freely on inspiration; there were no adhesions.

On January 10th he had 3,512,000 reds, Hb. 75 per cent.,

8,850 whites, of which 66 per cent. were polynuclears. Potassium iodide, which had been given at Netley, was continued.

January 11th, 1909.—Pain increased, temperature rising, more like abscess.

January 13th, 1909.—Whites, 15,933 ; polynuclears, 82 per cent. Patient was given ipecacuanha, grains 30.

January 14th, 1909.—Temperature normal, from which date it has remained normal.

January 18th, 1909.—Pain less ; liver rapidly diminishing in size ; patient looks and feels much better ; whites, 12,566.

January 25th, 1909.—Ipecacuanha stopped. Liver normal in size, but slightly tender on pressure. Blood : reds, 6,550,000, Hb. 87 per cent. ; whites, 8,800 ; polynuclears, 52 per cent.

Patient is now perfectly well, and has been discharged to duty.

The case is apparently confirmatory of Rogers' statements. The method is simple, and does not interfere with any exploration or operation which may be necessary if improvement does not take place. As Rogers points out, there is in nearly every case time to attempt this abortive treatment before more severe measures become necessary. In the two years before the date of his last paper no cases had occurred in the Calcutta General Hospital, where this treatment has been adopted. This appears an argument for the longer use of ipecacuanha in cases of dysentery which it appears to suit, a condition which is not invariable.

Major C. G. Spencer showed a case of sarcoma treated with Coley's fluid. (For particulars see p. 449.)

Captain H. B. Fawcus gave a demonstration on the use of a new medium for the isolation of *Bacillus typhosus* from excreta. A number of plates of the medium were shown to illustrate its inhibitory action on the growth of *B. coli*, and the distinctive appearances of the colonies of the micro-organisms which grow upon it.

For details, see JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, February, 1909, p. 147.

Clinical and other Notes.

THE TREATMENT OF EXCRETA IN INDIA BY PERCHLORIDE OF MERCURY AND INCINERATION.

By Lieutenant-Colonel W. A. MORRIS.
Royal Army Medical Corps.

The great importance and entrancing interest of the prevention of enteric fever among British soldiers in India must be my excuse for this communication, and for the opinions expressed, which are based on nearly eighteen years' experience of that country, and service in every part of it.

Our energies have been and now are directed against enteric fever on two very special lines, viz., (*a*) inoculation and rendering the soldier immune, and (*b*) removing the influence of the bacillus from the soldier and his surroundings, and thus lessening his chances of contracting disease. I refer in the present article to the latter of these. In hospital practice it has been the custom for a great many years to disinfect excreta, both solid and liquid, and render them harmless to produce further disease, and I think I am justified in stating that infection in hospital is comparatively rare. Out of seventy-seven cases in my experience since 1903 I only recollect one case, and that was not actually proved.

In 1906 an organised plan of destroying all enteric excreta by fire was introduced by the late Surgeon-General R. Harvey, Principal Medical Officer, Punjab Command. His simple sawdust and *chula* plan has remained the principle on which more expensive inventions have been grafted. Hospitals, at anyrate, are not and never have been of the slightest danger to troops in barracks, for they are too scrupulously watched and cared for. But notwithstanding all this care and attention in hospitals and barracks, enteric fever not only flourished, but began to assume very serious proportions, and the numbers rendered non-effective became considerable. Major J. C. Weir, R.A.M.C., the Sanitary Officer of the Punjab Command in 1903, was among the first to draw attention to the danger arising from barrack latrines and the flies which swarmed around them, and to suggest the importance of preventing the access of flies to the latrines. This resulted in a boom in patent fly-proof latrines. Thus our attention began to concentrate on latrines in barracks, where only two ways of getting rid of flies are possible, one by making a latrine absolutely fly-proof, and the other by rendering it an impossible place for a fly to exist in. One more point also began to be emphasised, and that was, that men apparently healthy, men suffering from the ambulant form

of enteric, and men discharged from hospital apparently cured, could infect any latrine. To make a latrine fly-proof is not only most expensive, but almost impracticable, so to render it impossible for flies to exist in the latrines was the only solution of the question.

Observation and examination gradually proved the latrines, the carriage system of excreta, and the trenches, to be points of great danger. The recognised and official dry-earth system was made as perfect as such a system possibly could be; more thorough disinfection of excreta was effected; and the methods of carriage and trenching were overhauled and improved; yet enteric fever showed no signs of abatement. But while advances have been made by military medical officers in cantonments, little or nothing has been done in civil parts adjoining the cantonments. A badly worked and badly supervised dry-earth system still remains, and is a danger in many cases to the cantonment.

The dry-earth system can be dismissed with a brief note. Thoroughly and well as it has been carried out, it is now wholly discredited. Among the many objections I will mention two: (1) No soldier ever applies 3 lb. of dry earth to an evacuation. If every man did so the four carts allowed per corps would not have sufficient capacity to carry the regimental excreta and urine, and the carriage to the trenching ground would immediately break down. (2) The great feature of efficiency in this method is to have the earth perfectly dry, and in a fine powder, but this is hardly ever obtainable. During the monsoons it is impossible to use dry earth, for a single day's rain is sufficient to prevent the required dryness and pulverisation. Again, in India uniformity is impossible, because soils differ so widely, the climate varies from very dry to very wet, and meteorological and terrestrial conditions are never similar in any two stations. It is, therefore, very evident that the dry-earth system, as carried out in India, is not only an uncertain, but a condemned one.

In 1903 I was appointed to the command of the Station Hospital, Sialkot, and proceeded there in July, and found myself in the middle of a severe outbreak of enteric. The causes were the usual ones, viz., bazaars and supplies, &c., but the dry-earth system flourished. In 1905 another severe outbreak occurred, and the earlier cases were derived from camps where the dry-earth system obtained on the road between Rawal Pindi and Sialkot; another outbreak was attributed to some tampering with the supplies. The dry-earth system was still carried on. The Medical Officer in charge of one corps was anxious to abolish dry-earth and substitute a modified perchloride system, and this I tried for the rest of the year, and on December 31st, 1905, I induced the General Officer Commanding to order the abolition of the dry-earth system and the introduction of the wet perchloride system throughout the British portion of the Cavalry Brigade. The results have been most striking.

SIALKOT.

	Cases	Mortality
1903	40 ..	12
1904	39 ..	9
1905	7 ..	2
1906	— ..	—

MURREE,[1] 1906.

	Cases	Mortality
Depôt	2 ..	—
Station Hospital ..	— ..	—
Cliffden	— ..	—

MUREE, 1907.

	Cases	Mortality
Depôt	— ..	—
Station Hospital ..	— ..	—
Cliffden	— ..	—

WESTBRIDGE, 1906-7.

I held sanitary charge of two British regiments and three batteries. There were three admissions for enteric and no deaths. These three admissions were infections from Lahore cantonments.

THE WET SYSTEM OF PERCHLORIDE OF MERCURY OR CARBOLIC ACID.

The wet system of perchloride of mercury as practised by me requires attention to the following details. I claim to have discovered nothing, but only to show how this system can be worked in a businesslike, practical, and economical manner. My long experience in India, and the many trials I have made, have convinced me that it is an efficient system and suitable to cantonments. The principal points are the following:—

(1) Preparation of the solution.

(2) Apparatus, receptacles, pans, conservancy carts, &c.

(3) Method of application.

Preparation of the Solution.—This is made on the following formula:—

℞	Hydrarg. perchloridi	grs. 40
	Sodii chloridi	,, 80
	Pot. permang.	,, 3
	Aquæ ad	pints 8

Sig. "POISON."

This makes a solution of the strength of 1 in 2,000. The question of strength is one upon which opinions differ. Major Lavie used 1 in 4,000, and reporting on a period of two years, stated that it was "most satisfactory," there being a complete absence of smell and flies. Others recommend a strength of 1 in 500. Koch found that a solution of

[1] Sixty-three enteric transfers passed through here. At the Depôt alone the dry earth system remained.

1 in 1,000 killed spores in ten minutes, whilst simply moistening the ground was sufficient to arrest their powers of development. At first I used a dilution of 1 in 1,000, but latterly one of 1 in 2,000. I think that is quite sufficient for all purposes.

The poisonous nature of corrosive sublimate has been advanced as a reason for its non-employment. In a dilution of 1 in 2,000, a tumblerful of solution might cause symptoms, but it would have such an unpleasant taste that no one would be likely to drink much by accident. I have never known anyone affected by this solution, except pariah dogs prowling about barracks at night and drinking the solution at the back of the latrine; many have been laid low in this way. Ordinary precautions are, of course, necessary, and these are met by making the powders at the hospital and handing them to trained sanitary orderlies. Perchloride of mercury is not more dangerous than the oxalic acid in the possession of every soldier for cleaning purposes.

The Material.—An Indian barrack latrine consists of a certain number of movable seats separated from each other by a wooden partition. Underneath the seat is placed a glazed earthenware pan fitting closely to the lower portion of the wooden seat. The pan is withdrawn from the back to a brick enclosure in which the receptacles are placed, and where the excreta are kept until removed to the trenches by the conservancy carts. I have noticed no special effect on these as the result of perchloride of mercury. The average life of the glaze in any case is about three months, if as much. The receptacles at the back are usually of two sizes. They are made of iron, and each is fitted with a cover. They should be air-tight, but as a matter of practice are not. It is usual to paint them with tar, and this invariably tends to loosen the cover. The conservancy cart is a receptacle lying between two wheels on a cranked axle and drawn by a buffalo. It is fitted with a double cover, and it is air-tight if the cover is correctly adjusted. These carts work the first two or three hours after dawn, and convey the excreta and urine from the latrines to the trenching grounds, a mile or so out of the station.

The Method of applying the Perchloride of Mercury System.—At the back of each latrine I only allow the exact number of receptacles to scale, and an earthenware urinal for the use of natives. The solution is kept in an ordinary oil drum of a capacity of 4 gallons, and through the screw opening is placed a pint tin syringe. The drum is painted red and labelled "Poison." In addition, a small iron skewer is allowed. I insist on nothing else being stored there, such as extra pots and pans, and clothes of the *mehter*. A pan having been used, the *mehter* removes it, disintegrates the solid contents with an iron skewer, and places them in the receptacle, cleans the pan, and returns it to its place with a syringeful of solution in it. The test of a good latrine is *absolute* cleanliness and

absolutely no smell. If there is the faintest odour it means that some more solution must be syringed over it.

Urinals are treated in the same way. I used sago tins for the purpose. In the corner above the trough the tin is fixed and arranged so that the solution drops into it. Here again the test is as above. I have noticed smell in a much-used iron urinal in the hottest sun. This must also be frequently syringed all over.

This concludes the description of the wet system of perchloride of mercury.

Carbolic acid in solution 1 in 20 is as equally effective as perchloride of mercury, and it is frequently used. The objections to it are: (*a*) It is a volatile acid and requires constant renewing; the mercuric salt is more stable and permanent. (*b*) The smell of carbolic acid conceals other smells and this is not the case with perchloride, that is to say, that any putrefactive smell can be recognised with the latter but not with the former. (*c*) Carbolic acid being used in so small a dilution as compared with perchloride of mercury, is more expensive.

As the dilution (perchloride of mercury) I have mentioned does not ward off flies altogether, the use of kerosene oil in any form has been found very effective. Kerosene alone or mixed with tar and earth makes a very good floor for any latrine, and flies do not settle on it. I think, therefore, that perchloride of mercury used as above to kill all bacilli, and kerosene lightly wiped over the wood-work and the upper part of each *gumlah*, will absolutely ward off all flies; either alone is insufficient, but both used together as suggested mean security.

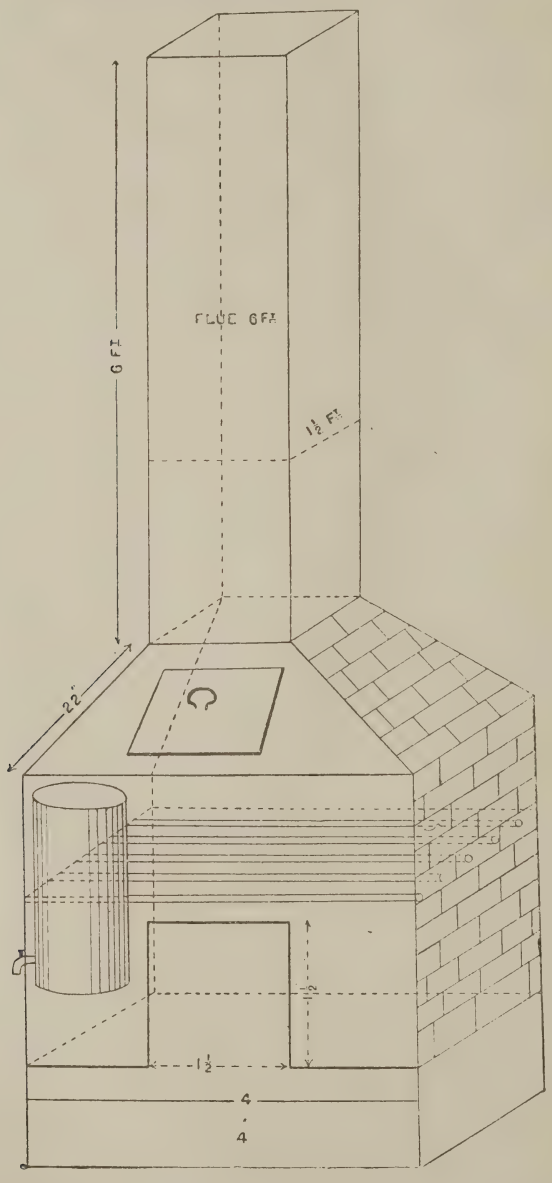
This brings me to the last stage of the disposal of the excreta, solid and liquid, from the latrines. The regulation method is that the excreta are carried by night-soil carts to trenches at a distance and buried. This method is well known and requires no detailed description. The horrors in the way of smells, &c., the dangerous foci of disease formed by the contents of these carts leaking, or the cart breaking down or turning over, are matters all who have lived in India have experienced, and these can be dismissed without further remark.

However, if we do not remove the excreta, we must dispose of them in another manner, and this must be by absolute means. This, I think, has been solved by incineration, and has been developed and associated in India with the name of Surgeon-General H. Hamilton, C.B., I.M.S., and Lieutenant-Colonel H. A. Haines, R.A.M.C.[1] The latter officer is associated with a larger form of incinerator, but the former rather advocates a smaller one. Incineration is no new idea, and many have been built at the large towns in India. These are costly to build and expensive to use. I do not refer to incinerators which can be built at a small cost and are economical in their working. Under the direction

[1] See Journal of the Royal Army Medical Corps, January, 1908, p. 34.

of Surgeon-General Hamilton, C.B., I.M.S., I built thirty-six of these incinerators in 1907.

FRONT ELEVATION.



The fuel used is litter and rubbish, horse litter if procurable is most suitable; this is kept in a dry shed. A layer of about 6 inches is placed over the grating, and the solid excreta, having been strained of all liquid,

are laid upon it, and covered by a layer of litter. More solid excreta can then be added, and the incinerator filled up with litter. It is then lighted from the bottom, and beyond occasional stoking no further attention is required. Anything more simple it is difficult to imagine. It is very often urged that the incinerator requires supervision, meaning a sort of special supervision, or a supervision of a skilled character. This is an error; skilled supervision is unnecessary, and at the Station Hospital the incinerator can be left safely in the hands of the Jemadar ward-sweeper. Another objection is smell. There is at first a slightly pungent smell, till the incinerator has warmed to its work, but there is nothing hurtful or deleterious in this, and it depends to a large extent on the moisture remaining with solid excreta. We overcame it by getting a good blaze on at once, and stoking well for the first quarter of an hour. The liquid excreta are the principal cause of smell, and it should be a strict injunction to the attendants not to let them boil. If raised to 160° or so, all hurtful germs of disease from this source are practically destroyed, and care should be taken that no vapour of steam is emitted. The economy is very considerable. In cantonments on the plains the introduction of incineration means the abolition of all the carriage of excreta from latrines to trenches.

THE SIALKOT INCINERATOR, AND INCINERATION IN THE FIELD.

By Lieutenant-Colonel B. SKINNER, M.V.O.
Royal Army Medical Corps.

The pattern of incinerator in use at Sialkot has been designed with a view to the complete combustion of human excreta, fæces and urine, with the aid of barrack sweepings (including dead leaves) or soiled stable litter, or both combined.

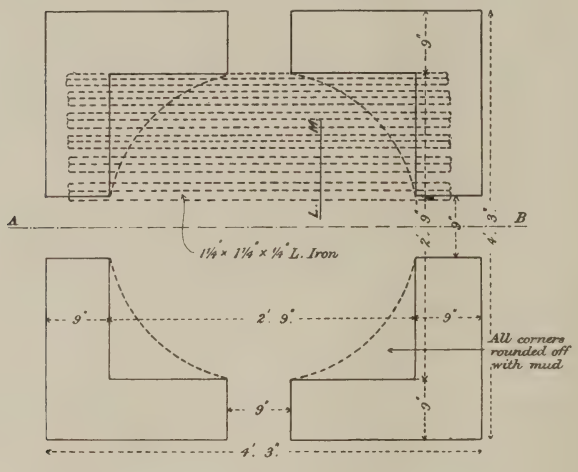
From the drawing it will be seen that the incinerator is of simple design, consisting of a furnace fed from above. The draught enters from four holes below the grating. The furnace is dome-shaped within so as to avoid corners wherein draught would be *nil*. The chimney is over the centre of the furnace. The feed-hole is on the dome just above the commencement of its curve from the side walls, but this feed-hole may be omitted in cases where a long chimney is not necessary, as in the field-service pattern.

The dimensions shown in the drawing are those of an incinerator capable of destroying in one day the refuse and excreta of a company—say 100 men—without excessive tax upon the sweepers in charge. This is calculated upon the work required in winter, when the urine for disposal is increased in quantity.

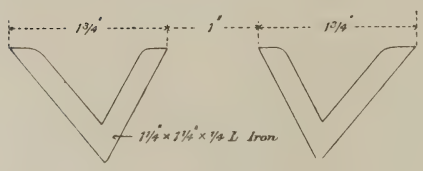
For the British troops at Sialkot one of these incinerators is built

adjacent to the back yard of each set of latrines allotted to a barrack. It is thus made available for the reception of excreta without the necessity for transport. And the idea is to maintain this principle wherever the incinerator is adopted, latrines being grouped around the incinerator at no greater distance than can easily be covered by a sweeper carrying a filled receptacle.

PLAN.



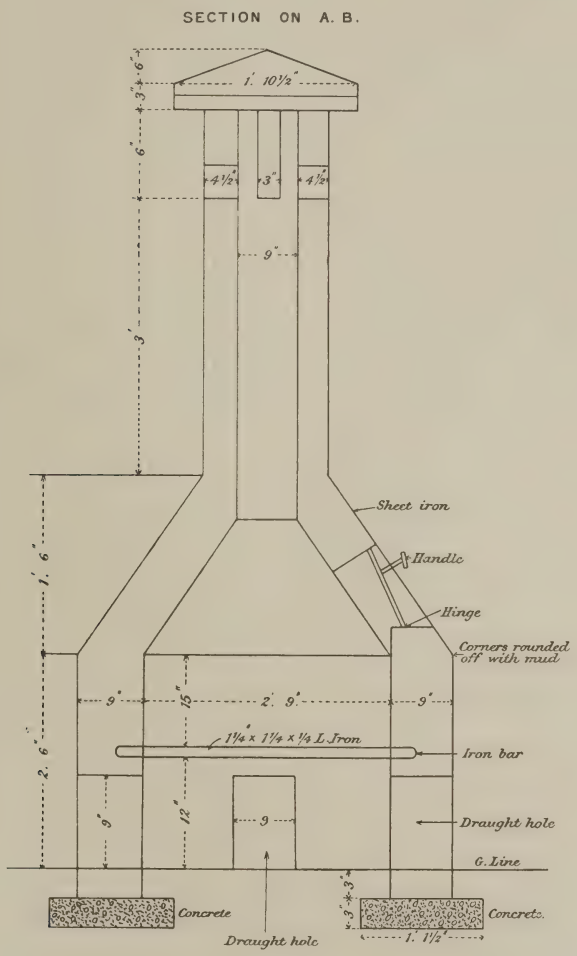
SECTION ON L. M.



(Scale full size.)

The system for the disposal of rubbish and excreta is as follows: There is a shed adjacent to the incinerator, within which sufficient stable litter and all barrack sweepings are deposited until required for use. Within the latrine pans a small quantity of sweepings or litter is placed. The pans are emptied into the fire as soon as they have been used; directly a pan is removed from under the seat a spare pan is put in its place. The urine receptacles are two-thirds filled with sweepings or litter. Lids are kept carefully over these receptacles, and when they are full the contents are emptied into the furnace.

The fire is started by placing a layer of sweepings 3 or 4 inches thick upon the grating. This is then lighted, and the contents of a filled receptacle or pan discharged upon the fire. Thereafter the fire continues to burn until the available excreta have been consumed, the only residue being a fine ash. The ash is taken away and deposited in a garden,



or is used for filling up excavations which would otherwise constitute mosquito-breeding pools at some seasons.

This form of incinerator has been in use at the station hospital for eleven months, and for the last few months has been in use throughout barracks. The advantage of a closed incinerator consists in the creation

of a constant draught, and the exclusion of rain and wind. The latter elements are prejudicial, for obvious reasons as regards rain and as regards wind, because the latter would blow dangerous matter about if the burning pile were exposed to wind of even moderate force.

During periods when dead leaves are not available, it is necessary to use stable litter as fuel. The quantity of litter essential for burning the excreta of 100 men is one dust-cart load per week. In places where sweepers can obtain more, they will use it; but the use of an excess of litter is not necessary, and is only justifiable when it is desirable to get rid of accumulations of stable manure, as in the field.

In the Sudder Bazaar an incinerator of twice the dimensions shown in the drawing disposes of the excreta of 500 individuals within the working day.

The material used by the Military Works for the construction of these incinerators has been second-class brick work in mud, pointed on the outside. The cost of each has been about 26 rupees. A less expensive incinerator can be built of sun-dried bricks for about 16 rupees. This will stand the rains of the Punjab if the outside is occasionally leeped, while its durability as regards general wear-and-tear is greater than that of the second-class brick ones, though the latter have a smarter appearance. The sun-dried brick or clay incinerator will not carry a high chimney.

The sanitary value of promptly destroying evacuations, and with them the microbes of diseases such as cholera, enteric fever and dysentery, cannot be estimated in a money equivalent. The expenses connected with the working compare favourably with the expenses of the dry-earth system. In barracks the same staff of sweepers as was necessary under the dry-earth system is requisite, but there is a saving due to the fact that Crowly carts are no longer required, and trenching grounds can be abolished, together with the staff necessary for their maintenance.

The system of the supply of fuel at seasons when there are no dead leaves available has to be considered. In barracks and hospitals there has been no expense incidental to this, as litter is obtained either from public or private stables.

In the cantonment rubbish is sold annually, the vendor having to cart it to the purchaser. At Sialkot this is effected at considerable loss to cantonment funds. If the cantonment were to burn off its own sweepings (and this system has commenced) a great reduction in the number of carts could be effected at once, as these would no longer have to travel some distance out of cantonments to dump their collections. The maintenance of carts might easily be reduced thus to one-half. Setting this as the cost of fuel against the present loss on the disposal of rubbish, it will be seen that the cantonment will not be a loser under this head.

II—Incinerators in the Field.

The incinerator in its simplest form is suitable for field work, and the main object of this paper is to make known the fact and the practicability of incineration of all animal excreta in the field. For field work the feed-hole may be omitted, the incinerator consisting of a clay dome with a short chimney through which the excreta and rubbish are placed in the furnace (fig. A.).

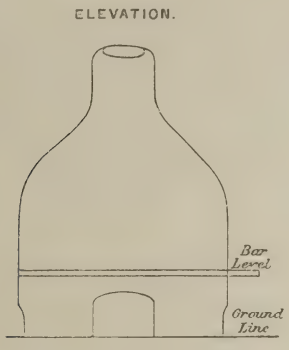


Fig. A.

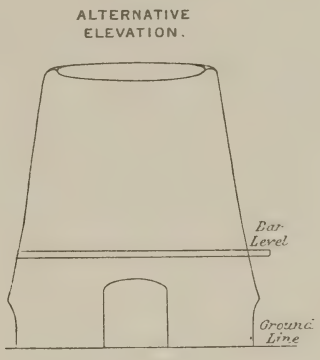


Fig. B.

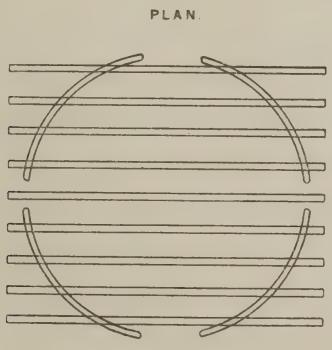


Fig. C.

Though the construction is simple it is efficient for the purpose, as I have proved by experiment at the station hospital, Sialkot, and subsequently in barracks and later in the field. In essentials the field incinerator resembles the destructor described by Lieutenant-Colonel Caldwell in "Prevention of Disease in Armies," but the cross-cut trench is not necessary; in fact, in countries with much rainfall it is objectionable. The requisites are some iron bars, a mud chimney, and receptacles for latrine excreta.

In India, in order to build the chimney the material most readily

available is the soil of the locality, and where that consists of loam or clay of sufficient consistency the process of building is rapid, especially if the material be moulded in the first instance into a brick-like form. Where the soil is excessively sandy, the wall must be prepared by means of pieces of roots of grass and other herbage. The function of the wall is to improve the draught and to prevent the dispersal of the litter by wind. It should not be built so high that the mouth of the incinerator is out of easy reach of the man operating; if the height exceeds 3 feet a step will be necessary.

In building the chimney the four holes for draught are left, as in the brick incinerator. The bars are laid across as soon as the wall is high enough to complete the draught holes; after that the wall is proceeded with until it is high enough to prevent the litter fuel being blown away. In no case is it necessary to build higher than 3 feet. In case of sandy soil it will be impossible to get higher than some 18 or 20 inches. The finished field incinerator presents something like the appearance shown in the figs. A, B, and C.

For field incineration the materials requiring transport are bars and latrine pans. The bars should be 4 feet in length, one end of each being left protruding from the wall so as to facilitate removal. A duplicate set of bars should be carried. The latrine pans are light iron receptacles such as are used in latrines for natives, but without the heavy stands necessary for the latter places. About three per company or five per squadron is the proportion required. In standing camps the receptacles can be replaced by kerosene oil or other tins.

On arrival in camp the sanitary party lays out the pans on the site selected for the latrines and falls to, making mud, or collecting material for the walls. The incinerator is completed in about an hour. As soon as fuel in the shape of litter, leaves, dry grass, &c., is available, a fire is started in the incinerator and the pans are emptied upon it. The cleaning of the pans is facilitated if some litter or rubbish is first placed in them. Urine receptacles are similarly dealt with.

When by experiment at the station hospital and in the lines it had been amply demonstrated that this simple incinerator was competent to effectively destroy excreta—liquid as well as solid—a further experiment was made in the field. A battery of horse artillery was furnished with the necessary materials, and erected an incinerator at every camp during its march to and from its annual practice camp. The result was all that was desired. Further experiment was then made with cavalry and infantry, both British and Native, at manœuvres, with equal success in all cases where the units were collected. When the units were split up the experiment could not be continued as the available materials were insufficient to extend it universally; it was necessary to limit the experiment to the larger bodies. But when the feasibility of the system is officially recognised, and the necessary material and transport are

sanctioned, incineration can be effected in the case of every detached party of men.

The equivalent of one mule (carrying 160 lb.) will be sufficient transport for this purpose for a battalion. The main difficulty about transport for this sanitary purpose in India lies in the caste prejudice which precludes anyone but the sweeper class touching the materials used in incineration; but with the sanitary organisation now available there will be no such difficulty if a special transport is supplied for the use of the sweepers, such transport consisting of mules or donkeys. The training of the rank and file in sanitation is now becoming so thorough that there is no difficulty in getting the details systematically carried out under the supervision of the sanitary orderlies.

This method of incineration supplies the finishing touch to sanitation in the field whether in peace or war, as the evacuations of men suffering from bowel diseases can now be destroyed as soon as passed, and when the practicability of the measure is generally known, every camp and bivouac in Europe as well as in Asia will in the near future be provided with these incinerators.

A CASE OF SARCOMA TREATED WITH COLEY'S FLUID.

By Major C. G. SPENCER.

Royal Army Medical Corps.

Serjeant C. W. L., aged 33, service thirteen years, was admitted to hospital at Bulford on July 21st, 1906, complaining of a hard, painful swelling in the lower part of the abdomen, with frequent and somewhat painful micturition.

History.—He has always been a healthy man. He had enteric in India in 1895. In September, 1905, he was operated on for right inguinal hernia, and he thinks the hardness in the abdomen and the "weakness of the bladder" came on shortly after the operation. According to his own account the swelling has not increased in size, and is less tender than it was at first. He passes urine every three or four hours, only about a wineglassful at a time. No history of gonorrhœa or stricture. Family history good.

Present Condition.—A rather thin, spare man, with an anxious expression. General health good, he sleeps well and has a good appetite. On examination, a large, very hard, and slightly tender swelling can be felt in the lower part of the abdominal wall, reaching from the pubes to within $1\frac{1}{2}$ inches of the umbilicus, almost exactly in the middle line, and measuring about 3 inches across. It appears firmly attached to the pubic bones. The skin over it is free, and the tumour is evidently in the abdominal muscles. He complains of some pain towards the end of micturition, as well as of the frequency before noted. The urine contains a trace of albumen, but no casts, mucus, or blood.

On July 27th he was examined under an anæsthetic. No further details as regards the tumour could be made out. A catheter passed without difficulty, but the bladder would only hold about 3 ounces. On rectal examination the prostate was found enlarged, but the tumour could not be felt.

During the following three weeks he seemed to be getting thinner, but no increase in the tumour could be made out, though it became less tender. The urinary condition continued unchanged. He was transferred to Millbank on August 20th, 1906.

On admission to Millbank the condition was as described above, except that the urine was normal, the frequency of micturition less, and on rectal examination a hard mass could be felt in front of the prostate, evidently forming part of the tumour.

By August 31st he had gained 4 lb. in weight since admission, but otherwise there was no change.

On September 5th, 1906, an exploratory incision was made under chloroform. The growth was found to involve the recti muscles, to be firmly attached to the pubic symphysis, and to extend down in front of the bladder to where it could be felt *per rectum*. As his consent to an extensive and dangerous operation had not been obtained, a piece of the growth was removed for examination, and the wound closed. He made an excellent recovery from the operation. Microscopical examination showed the growth to be a spindle-celled sarcoma infiltrating the abdominal muscles.

On September 11th an attempt was made to remove the growth, the recti were divided above their upper limit and the tumour partly separated, but as the peritoneum lower down was found to be widely involved the operation was abandoned and the wound closed, the divided muscles being sutured. The wound healed without trouble.

On September 22nd injections of Coley's fluid (the mixed toxins of *Streptococcus erosipelatosus* and *Micrococcus prodigiosus*) were commenced. Injections were given on alternate days, commencing with ½ minim and increasing to 3 minims, which latter dose caused a sharp febrile reaction with headache and shivering about two hours after the injection, lasting about four hours. The injections were made into the substance of the tumour and caused well-marked local inflammatory reaction. After twelve injections had been given they were discontinued, as no appreciable effect had been produced on the growth, and the patient's general health was markedly affected; he had lost flesh and suffered a good deal from the reaction after each dose. He was discharged from hospital on "sick furlough" on October 13th, and the gravest prognosis was formed.

He returned from furlough two months later, having improved most strikingly in general health, gained 15 lb. in weight, and taken active walking and cycling exercise without discomfort. The tumour was

distinctly smaller and softer above the symphysis, though a hard mass could still be felt *per rectum*. He stated that "a fortnight after the injections were stopped he felt sore in the tumour, as if it were ulcerating," and he then noticed that it was getting smaller, softer, and more movable.

A second course of injections of Coley's fluid was given between December 16th, 1906, and January 11th, 1907, fifteen doses of from 1 to 6 minims being given. At the end of that time the treatment was stopped, as the growth had become very tender, and his general condition had deteriorated in the same way as during the first series of injections. He was again sent on furlough on January 21st, 1907. The tumour was then greatly reduced in size.

On re-admission a month later his general health had improved, and he had gained 13 lb. in weight. While on furlough he had walked and cycled a great deal. The bladder symptoms had entirely disappeared. He had again had some pain in the growth, which had further diminished in size.

A third course of injections was given, 6 minims in each dose, nineteen injections in all being given between February 23rd and March 28th.

On April 3rd, 1907, he left hospital, having been invalided. The growth had then very greatly diminished in front, above the pubes, but the mass felt by the rectum seemed unaffected, as the injections did not reach it. He was heard of from time to time, the report always being that he was in perfect health, but he was not seen again until December 10th, 1908, when he came up to show himself. No trace of the growth could then be found either in the abdominal wall or by rectal examination, and the operation scar was firm. He had been in excellent health ever since leaving hospital.

Remarks.—For the notes of the above case I am indebted to Captains C. W. Holden, J. W. H. Houghton, and H. F. Shea, R.A.M.C., and for the report on the tumour to Lieutenant-Colonel C. Birt, R.A.M.C.

The case is, I think, undoubtedly one of sarcoma, as both the clinical and pathological evidence confirmed that diagnosis. The patient will be kept under observation, but as nearly two years have now elapsed since the termination of the treatment any recurrence is most improbable. The Coley's fluid used was obtained from Messrs. Parke, Davis and Co., and only freshly prepared fluid was used, the total number of injections given being forty-six. Although this treatment often gives disappointing results, still if even an occasional case can be saved it is worth trying in all cases of inoperable sarcoma, and a good many satisfactory results have been recorded.

SUPRAPUBIC PROSTATECTOMY IN A PATIENT AGED 71 YEARS 5 MONTHS: RECOVERY.

By Captain W. J. P. ADYE-CURRAN.
Royal Army Medical Corps.

The rarity of cases of prostatitis presenting themselves for treatment in the Army, owing to the age at which this condition is usually found, has induced me to send the following report of a case in the hope that it may be of interest.

W. J. S., a carter by trade, aged 71 years 5 months, employed by a firm of civilian contractors in camp on Salisbury Plain, was brought to hospital at Bulford on August 10th, 1908, suffering from acute retention of urine. He stated on admission that the medical officer in camp had attempted to pass a catheter, and failed, and had consequently sent him in a conveyance to hospital.

History.—The patient gave the following history on admission: About three to four years ago he noticed some difficulty in passing urine. He visited a doctor on one occasion when he had apparently an attack of retention, and was relieved by catheter. Since that time he had been passing a No. 8 gum-elastic catheter for himself about every two or three months, when he found difficulty in voiding his urine. For the past three or four years he had to get up three or four times nightly to pass his urine, which he did in small quantities at a time and with considerable straining.

Condition on Admission.—He looked apparently a healthy and well-nourished man, and not more than his stated age. He said he was always subject to indigestion and flatulency, for which he constantly took pills. His pulse intermitted every four to six beats, and the arteries were atheromatous. The lungs were normal; he had no cardiac murmur; his teeth were bad and deficient. Arcus senilis was well marked in both eyes. When admitted he was in great pain, shouting to be relieved. Some adrenalin solution was injected into the urethra, and a No. 10 silver catheter tried, but without success. Two strictures were met with in the urethra; one in the penile portion and the other anterior to the triangular ligament. Both these were passed after some manipulation. The chief resistance met with was from a greatly enlarged and inflamed prostate. The patient was then placed in a hot bath, and attempts to pass different-sized catheters were tried, all of which were unsuccessful. Suprapubic puncture was then performed, and about 10 to 12 ounces of turbid urine were drawn off. The urine on analysis was found to be alkaline, and contained albumen, blood, and a thick sediment.

The progress of the case was as follows: August 11th, 1908: Patient spent a very restless night; spasmodic pains at intervals, making him almost shout. Further attempts to pass instruments failing, he was

again punctured over the pubis. August 12th, 1908: The patient was given an anæsthetic, and further attempts to pass catheters, guided by a finger in the rectum, made, which were again unsuccessful. A further puncture over the pubis was performed, this time the cannula being fixed *in situ*, and a rubber tube attached, the urine being drained into a receptacle at the side of the bed. August 13th, 1908: The cannula drained fairly well, and the patient was comfortable. August 14th, 1908: An attempt to replace the cannula by a rubber catheter (No. 5) failed, owing to the opening in the bladder being difficult to find. Smaller sizes passed through the cannula got blocked, and would not drain. August 15th, 1908: The bladder was aspirated suprapubically with a No. 6 trocar and cannula, the cannula being fixed *in situ*. August 17th, 1908: The cannula worked satisfactorily. The patient had considerable pain referred to the perineum, and a continual desire to pass urine. With adrenalin injection further attempts were made to pass instruments, but without success. The supra-pubic region at the site of the punctures presented a sloughy, unhealthy appearance, which was dusted with iodoform powder. The cannula was replaced by a No. 5 gum-elastic catheter, which passed easily into the fistulous opening in the bladder, after removal of the cannula. August 18th, 1908: Catheter acted fairly well, but patient generally in a very restless condition. August 19th, 1908: No. 6 catheter inserted. Drainage difficult owing to the patient's restless condition, it being difficult to keep the catheter in position. Further attempts were made under an anæsthetic to pass catheters without avail. August 21st, 1908: No. 8 gum-elastic catheter inserted. Patient's general condition improved. The amount of blood in urine has increased. Urotropine, boric acid and hyoscyamus given internally. August 24th, 1908: Urine drained satisfactorily through catheter. However, as the patient's condition was far from satisfactory, and did not hold out much hope of improving further than having a permanent fistulous supra-pubic opening, the question of the removal of his prostate was explained to him. He readily agreed to this; in fact, his nervous anxiety about himself caused him to ask for something more to be done. Accordingly, it was arranged to do a supra-pubic prostatectomy on the 27th, the prostate apparently being a suitable one for removal. The operation was not done immediately, to allow time for the urine to become clear, if possible. The bladder was washed out daily with a 2 per cent. boric solution through the sinus.

August 27th, 1908: Lieutenant Dickson, R.A.M.C., giving chloroform, with Lieutenant Hendry, R.A.M.C., assisting, an incision 3 inches in length was made in the middle line between the umbilicus and the pubes and the left rectus split. The pre-vesical fat was cautiously divided and retracted. The peritoneum was not seen. The bladder wall was fixed with two hooks, and the knife plunged into its cavity. The wound in the bladder was enlarged by stretching until it admitted two fingers easily. The interior of the bladder was examined hastily for stone, &c. A fair

quantity of hard blood-clots lying behind the prostate were removed digitally. An incision with a blunt-pointed scissors was then made over the most prominent part of the prostate; the nail of the index-finger of the left hand being used to scratch until the layer at which an enucleation took place was found. The right hand was gloved, and two fingers introduced into the rectum were used to push the prostate up to meet the left hand in the bladder. Some considerable difficulty was experienced in freeing the apex of the prostate, which did not shell out cleanly. The whole of the gland being separated, it was removed by compressing it with forceps. A large rubber tube ($\frac{3}{4}$ inch) was introduced through the vesical opening, which it almost filled. No sutures were introduced into the bladder wall; two strong catgut sutures were introduced into the upper portion of the abdominal wound, passing through all the structures of the abdominal wall. The cavum Retzii was lightly packed with gauze and left open. The bladder was irrigated with boric lotion through a silver catheter introduced through the urethra, the fluid escaping through the abdominal tube. The fluid was blood-stained at first, and then clear. The tube was retained in position by a salmon-gut suture. The wound was dressed and the patient put back to bed. The patient stood the anæsthetic and operation well.

The prostate weighed 4 ounces 1 drachm, and showed a so-called middle lobe. The enucleation was apparently carried out between the fibrous and pathological layers.

August 28th, 1908: Patient was kept sitting up after the shock of the operation was over, and his position changed frequently to obviate any chance of his getting congestion of the lungs or bedsores. He developed a persistent hiccough, which was checked after twenty-four hours apparently by minim doses of tincture of iodine.

The following method for keeping him dry was employed, and found to be eminently satisfactory. The vesical drainage tube was made to project about 2 to 3 inches out of the wound. A large piece of jaconet was perforated for the tube to pass through, and fastened by plaster half way up the projecting portion of the tube. The jaconet was folded on itself, and in this way was used as a receptacle and funnel to receive and carry off the urine into a basin at the side of the bed. The abdominal wound was dressed under the jaconet and kept quite dry. The mouth of the drainage tube was lightly covered with gauze to protect it. The bladder was irrigated with a 2 per cent. boric solution through the tube twice daily.

On the fourth day after the operation the drainage tube was removed, and a piece of jaconet with an aperture for the wound was made to adhere to the skin by means of collodion and gum. The jaconet was used in funnel shape as before. The irrigation was carried out twice daily until September 7th, when the opening in the bladder wall became too small for the purpose. A No. 8 silver catheter was then introduced

per urethra, and the bladder washed out by this means. On the introduction of the instrument about 2 ounces of thick foul-smelling pus were evacuated. After this the patient was able to pass small quantities of urine normally for the first time. On September 10th slight extravasation of urine took place into the scrotum, which became red and œdematous on the right side, the right spermatic cord being greatly thickened and painful. The temperature rose slightly. Incisions were made into the tissues, and hot baths given. The condition quickly subsided with a slight amount of sloughing.

The further progress of the case was uneventful. The patient was discharged from hospital on October 14th, 1908. The pus had disappeared from the urine by September 21st, and the patient was able to hold his urine for several hours and pass it normally. The abdominal wound was quite healed, and the scrotal wounds were looking healthy. The urine was almost clear.

NOTE.

November 16th, 1908: Patient was seen by me after my return from leave. He appeared to have put on considerable weight, and looked extremely well. He stated he was feeling better than he had been for years, and was retaining and passing his urine quite normally. He passed some in my presence; the stream was full and forcible, and the urine was perfectly clear. On examination it contained neither blood, albumen, nor pus. The abdominal and scrotal wounds are perfectly healed, leaving firm scars.

Since the above note I have seen the patient frequently, and his satisfactory condition is maintained. He has resumed his employment.

FURTHER NOTES ON SURGICAL TECHNIQUE.

BY MAJOR F. E. GUNTER.
Royal Army Medical Corps.

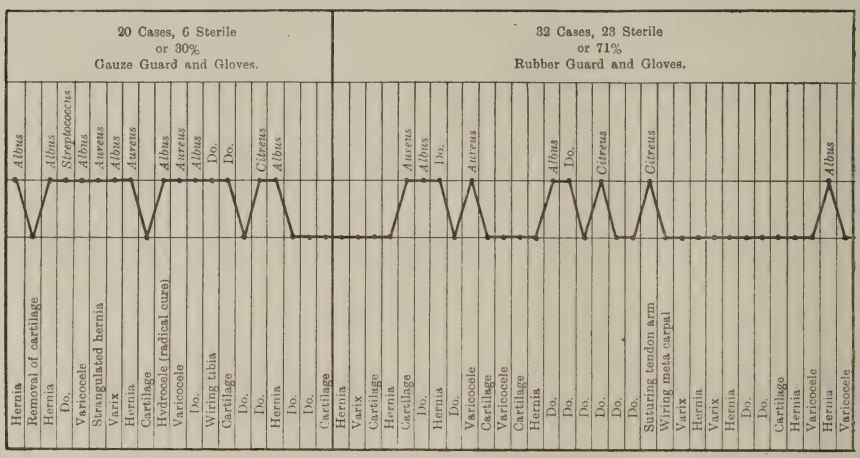
SINCE my last article on this subject published in the May number of the Journal, 1908, the procedure at the Curragh has been slightly modified.

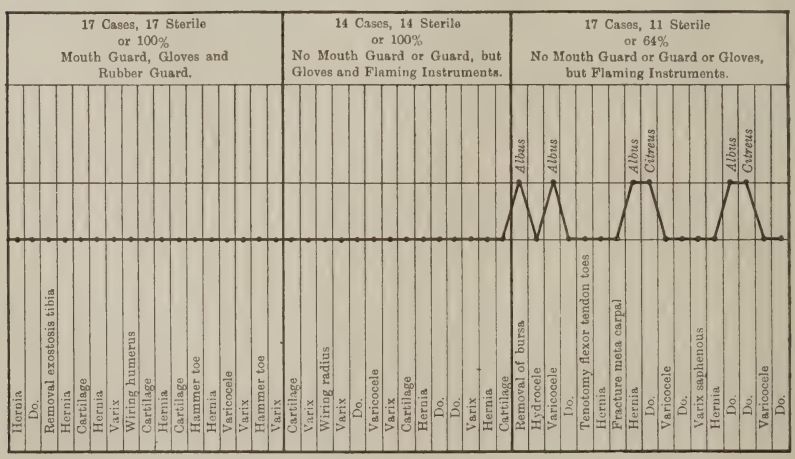
The tendency has rather been to drop those precautions which do not appear to be absolutely necessary. We have been trying to work as simply as possible, realising that the Army Medical Officer, working as he does under such varying conditions in all parts of the globe, should get into the habit of using simple methods.

Perhaps it may be well, before going further, to summarise as shortly as possible the procedure at present adopted.

All dressings are sterilised in the disinfector. Old biscuit tins have been substituted for the drums usually employed. Instruments are, without exception, boiled and placed on a dry towel for use. No water

or lotion is used throughout an operation, except at the commencement for the cleansing of the operation area. The skin of the patient is not prepared in any way, beyond shaving the night before, till he is under the anæsthetic. I am of opinion that harm may be done by too much washing. It certainly irritates some skins and all that is now done is to





NOTE.—By "Cartilage" is meant removal of articular cartilage of knee-joint; by "Varix saphenous" is meant ligature of saphenous vein in thigh for varicose veins.

gently wash the part, without using a nail-brush, with soap and water, and then to apply a little alcohol.

During the operation, each instrument after it has been used is passed to an orderly, who dries it thoroughly, and then holding it in a pair of forceps passes it through and through the flame of a spirit lamp in the

same manner as he would if working in a laboratory. He then places it amongst the clean instruments for further use. Any instrument thus flamed is fit for use with the next case. In this way considerable time is saved.

I find this flaming of instruments especially useful when dressing cases in the wards. It is essential that the instruments should be quite dry before flaming, or there is a risk of their being insufficiently sterilised.

Every ligature is threaded with a needle previous to sterilisation, and is then put up in a separate test-tube and the needle stuck into the cotton-wool plug. The tubes are then sterilised in the disinfector. On a ligature being required the orderly removes the plug and along with it the needle and thread. The needle can be removed from the thread if preferred, but, personally, in tying arteries, I usually under-run the neighbouring tissues.

In the accompanying chart are shown the results of 100 consecutive operations upon non-septic cases, about half performed by myself, the remainder by other officers in the station.

Each case in which the sutures removed from the wound on dressing proved to be sterile on bacteriological examination is shown on the lower line in the same way as a normal temperature is recorded in a temperature chart. When pathogenic micro-organisms have been detected this is indicated by a dot on the upper line. The organism found is noted in each case above and the operation performed below. This is a graphic way of showing results and saves much writing. (It should be explained that none of the cases became septic, but the object aimed at was bacteriological perfection.) The precautions taken are shown at the top of the chart.

The first twenty cases were unsatisfactory, only 30 per cent. of the sutures being bacteriologically clean. I thought that this was possibly the fault of the gauze guard and substituted a rubber guard in the next twenty-three cases. There was a considerable improvement, 71 per cent. of the sutures being sterile.

This, however, was not perfection; so I next, in addition, used a mouth-guard. The result was perfect, all the cases were sterile. Mouth-guards are, however, uncomfortable, and I cannot but think they are injurious to the wearer, so I stopped the use of them. At the same time I did away with the rubber-guard, but flamed my instruments. Fourteen cases were operated on and all proved sterile.

Getting bolder, I dropped the use of gloves and the results got worse. In seventeen cases only 64 per cent. were sterile. I deduce from these experiments that the use of gloves is desirable if you aim at bacteriologically perfect results, and that a guard for the mouth and operation area are unnecessary.

The chief object of flaming is to remove any slight contamination of the instruments which may have occurred during the operation.

In conclusion, I would like to express my thanks to Lieutenant-Colonel F. A. B. Daly, C.B., and brother officers here, for much kindly advice and assistance, and to Private Buckell, laboratory attendant, for aid in working out bacteriological data.

[HOW TO DEAL WITH THE SAC IN OPERATIONS FOR INGUINAL HERNIA.

By Major F. J. W. PORTER, D.S.O.
Royal Army Medical Corps.

As Captain Churton has pointed out in the Journal for December, the isolation of the sac is not in all cases by any means a simple matter, and constitutes practically the most difficult part of the operation. I should like to mention the method which I have adopted for many years past, and which has proved satisfactory.

The sac is invariably to be found at the lower border of the internal oblique, in front and to the inner side of the cord, covered simply by cremaster muscle. The lower edge of the internal oblique is forcibly retracted upwards and outwards. With two pairs of dissecting forceps, the cremaster muscle is stripped inwards and outwards in a direction parallel to the cord, exposing the sac, which can of course be recognised by its white appearance. The sac is now picked up by two pairs of Spencer Wells forceps applied at right angles to its long axis and held by an assistant.

An incision is very carefully made through the sac between the points of the forceps and deepened until a shining membrane is seen. This is, of course, the posterior surface of the sac lined by peritoneum. The edges of this incision are now held by forceps and a blunt dissector is passed into the sac in an upward direction. If the sac has been properly opened the instrument passes into the abdomen *without the slightest resistance.*

The opening of the sac is now enlarged upwards and downwards so as to admit the left forefinger. This is inserted and the edge of the sac gripped between it and the thumb-nail at the cut edge. With a pair of dissecting forceps, the structures of the cord are stripped from the sac, keeping very close to it and working *in a direction at right angles to its long axis.* As the stripping progresses, the sac is pulled towards the operator and firmly held by the thumb-nail against the forefinger. In this manner it is possible to work round about three-quarters of the sac. The circle is completed by working in the opposite direction in the same manner. The stripped sac is now quite free from the cord for about the space of one inch, and the cord is still firmly adherent to its natural bed. The stripped portion of sac is then clamped by a Spencer Wells forceps and cut across.

In the case of a congenital hernia, it is advisable to close by a ligature the upper end of the portion of sac which it is intended to leave.

It will be seen from this description that it is not considered necessary to isolate or remove the whole of the sac. Only sufficient is detached to enable it to be dealt with in the later stages of the operation.

The assistant now holds the cord with a piece of gauze, and draws it steadily downwards, while the operator draws the sac in the opposite direction and strips it off the cord. This isolation is systematically done, each aspect being cleared in turn, and all purposeless tearing is avoided. The stripping is continued until the sac is seen to widen out into a funnel, and the epigastric vessels are either seen or felt on the inner side. I do nor think the importance of isolation to this extent can be exaggerated.

There are a few operators who are content with ligature of the sac at the external ring, or a little above it. In my opinion such "radical cure" will be very likely to relapse. I think we cannot depend on any operative measure which does not entail ligature at the very highest point, and this can be easily identified by the presence of the epigastric vessels. For cases of large herniæ with a very dilated inguinal canal it is necessary to narrow the latter by some method such as Bassini's, but I think in other cases it is quite unnecessary, provided one has dealt with the neck of the sac *at the internal ring.*

Having fully isolated the sac, and ascertained that it is empty, transfixion is made *from the inner side,* so as to avoid puncturing the epigastric vessels, and a Staffordshire knot put round the sac, traction in a forward direction being made while it is being done. I always use kangaroo tendon for this purpose. The sac, *in the twisted position,* is then pulled upwards under the free edge of the internal oblique and through a hole made in this muscle by carrying the needle through the twisted sac. This causes a convexity on the peritoneal surface.

The operation is completed in the usual manner, but if Bassini's method is used the cord must be lifted from its bed first, in order to pass the sutures behind it.

A SYSTEM OF SANITARY CONTROL FOR MILITARY CANTONMENTS IN INDIA.

By Lieutenant-Colonel R. E. R. MORSE.
Royal Army Medical Corps.

This subject is of such vital interest to the Army in India that no excuse is required for my bringing to notice a scheme of sanitary supervision which I have found work smoothly and with good results. During a long experience of Indian cantonments, I have found, on joining a station for duty, that rarely was there a complete record of

sanitary defects and recommendations for their improvement; neither were there any easily accessible means of finding out the steps taken to remedy the defects thus pointed out. Some stations have a sanitary book for use in the station hospital, seen only by the officer commanding the hospital and the officers doing duty under him, and which is seldom kept up; or there may be files of weekly sanitary reports, to which little attention is paid. These latter mostly consist of mere statements of certain routine inspections having been carried out. It thus happens that the senior medical officer, who is the real health officer of the station, has no ready means of making himself acquainted with the state of his charge or the work of his predecessor. He may laboriously wade through the sanitary book, files, and perhaps letter book, and still be ignorant of many matters of importance in connection with the health of the troops in his new charge.

The system of control that I now bring to notice I found in partial operation in Wellington, Madras, about the year 1898, so that I make no claim of being its originator. So impressed was I with its utility, that I introduced it into two of my three subsequent large stations, with, I think I may say, much success and great benefit to general sanitation.

The "Station Sanitary Register" is kept as follows: A large copy book—1 A.F.Z. 2067 is suitable—is taken into use, the left-hand page being for the weekly sanitary report of the assistant sanitary officer who is the officer in charge of the cantonment general hospital. The right-hand page is ruled to form four columns under the headings of "Senior Medical Officer of Station," "Cantonment Magistrate," "Garrison Engineer," and "Officer Commanding the Station."

The usual routine is that this register is passed by the senior medical officer, with any necessary remarks, to the different officers concerned, and finally to the officer commanding the station. At Lucknow there are about twenty-two different garrison institutes, dairies, markets, mineral water and ice factories, &c., to be inspected. A numbered list of these is kept in the first page of the Register, as also a similarly numbered tab which can be moved as required. The report thus gives each institution under its own number and in its usual order. The book then becomes a permanent and easily accessible record of the sanitary work in the cantonment, and a relieving senior medical officer or commanding officer of the station can soon acquaint himself with the work of his predecessors, a thing that was almost impossible under the old system of reports.

Besides the "Station Sanitary Register," a similar "Regimental Sanitary Book" is in use for each unit in the garrison. After the weekly report is completed by the medical officer in charge of a corps, the senior medical officer makes any remarks he may consider appropriate, and forwards it to the officer commanding the corps for his information and action. There are here five British units, and on the departure of any one of them the sanitary book is passed on to be used in connection with

the relieving troops, so that it is in a great measure a record of the sanitation of the lines rather than of any particular corps. The practice I have carried out ensures that medical officers will be in direct communication with the officer commanding, as his sanitary advisor, and not, as frequently occurred under the old *régime*, of communicating with him through the quartermaster, a junior regimental officer, or the pioneer serjeant. Without exception my experience has been that commanding officers fall in readily with this scheme, and prefer having sanitary suggestions and recommendations at first hand, if these are made in a tactful and in a reasonable manner.

I claim for the scheme :—

(1) A concise and accessible record of sanitary work.

(2) A great saving of clerical labour, in that no other office record, letter book, &c., is required in addition to this Register.

(3) It brings the commanding officer into more immediate touch with his sanitary advisor.

(4) It leads to a vast improvement in general sanitary supervision.

(5) It is of great assistance to the senior medical officer in enabling him to become acquainted with the methods of working of the medical officers doing duty under him, and to co-ordinate those methods without interfering with individual initiative or any original measures that may seem advisable and feasible. He can see that medical officers work on a more or less uniform system, and prevent the recommending or carrying out in different parts of his sanitary area of measures which may be opposed to one another.

(6) The continuous record will enable sanitary officers to avoid the pitfall of making recommendations at variance with those previously made, as often occurs in small matters of detail. This latter often brings discredit on our corps, as regimental officers will often not understand that frequently there are many different ways of reaching any particular goal, and may possibly consider it another instance of " doctors differing."

(7) Persistent disregard of recommendations or obstructions on the part of reponsible officers is shown up in a manner that sooner or later brings its own condemnation.

As perhaps the most prominent part of this scheme, I would insist on the importance of the position of the senior medical officer as the health officer of the station, supervising all, seeing that all recommendations are reasonable, and that the different medical officers conform to a general plan of working suitable to local requirements.

Report.

THE SECOND INTERNATIONAL CONGRESS ON SCHOOL HYGIENE, LONDON, 1907.

By Lieutenant-Colonel A. M. DAVIES.
Royal Army Medical Corps (R.).

This Congress was held in the early part of 1907, but for various reasons the published Transactions were not able to be issued until the latter part of 1908. The record of proceedings, occupying about a thousand pages octavo and divided into three volumes, has been produced under the joint editorship of Dr. James Kerr and Mr. White Wallis. These volumes form almost an encyclopædia of present-day knowledge on all branches of hygiene and physiology as applied to educational matters, as may be seen from the titles of the reports on the various sections into which the Congress was divided. These were: Physiology and Psychology of Educational Methods and Work, Medical and Hygienic Inspection of Schools, Hygiene of the Teaching Profession, Instruction in Hygiene for Teachers and Scholars, Physical Education and Training in Personal Hygiene, Out of School Hygiene, Contagious Diseases, Ill-health, and other Conditions affecting Attendance, Special Schools for Feeble-minded and Exceptional Children and for Blind, Deaf, and Dumb Children, Hygiene of Residential Schools, and, lastly, the School Building and its Equipment.

In all Congresses it is difficult for any conscientious member to put in an attendance at all, or even nearly all, the meetings that he wishes to be present at; a selection must necessarily be made where several are held simultaneously. At this Congress the difficulty appeared to be very great, there being eleven sections, and therefore, as a rule, eleven separate meetings being held concurrently. Although certainly no fault could be found with the management of the Congress as a whole, because it was a conspicuous success, with regard to some of the sectional meetings there seemed to be occasionally a waste of time in one way or another, and the scientific *work* had sometimes to give way to the imperious demands of a congressional excursion.

The Inaugural Address by Sir T. Lauder Brunton on August 5th was commendably brief and to the point. Two subjects specially dealt with by the President may be here alluded to, and his own words cannot be profitably condensed: "The great advantage of a Congress like this is, that the systems employed in various places are brought together and compared, so that each country may learn from the others the useful

plans they ought to adopt, and the errors they ought to avoid. One of the most important subjects of all in this respect is that of medical inspection of schools, because this is the keystone of physical education. Without it, the defects of eyes, ears, nose and teeth, which affect individual scholars, cannot be ascertained; and so those children remain backward in their learning, suffering in their bodies, and so much damaged in physique, that they are unfitted for many occupations, cannot enter the Army, and go to swell the numbers of the criminal classes. Moreover, such defects are most expensive to the country. It has been found in New York, as I am informed by Dr. Gulick, that "it is far cheaper to see to it that these children have eyes and ears, noses and throats, which permit of their progressing through the school at the regular rate, than it is to keep them in the lower grades of the school where they do not progress, furnishing them school-room and expensive instruction year after year, when they are not taking advantage of such instruction." Equally important are those hidden defects of heart and lungs, which render the physical exercises (suitable for others) harmful and dangerous to the child with a weak heart, and make a child suffering from phthisis unsuitable for school life, and a source of danger to its companions. By early recognition of phthisis in a child, it may not only be prevented from spreading the disease, but, by proper treatment, it may be cured and grow up to be a useful citizen. By the early detection and isolation of infected children the necessity for closing schools may be, to a great extent, prevented, the spread of skin diseases completely checked, and even a fatal disease like diphtheria may be almost stamped out.

"One of the most useful stimulants to the circulation and nutrition, both of children and of grown-up people, is pleasure, and anything that adds to it helps to develop both mind and body. There is a great fear in this country of militarism, and I doubt if there is anyone in this country more desirous of peace than myself. But one cannot watch children without seeing what an enormous pleasure a pop-gun gives them, and I doubt if one could find three peoples freer from the military spirit than the American settlers, who beat our armies a little over a century ago; the Boers, who nearly did the same a few years ago; and the Swiss, who spend more on education and less on military training per head than any nation in Europe; yet they were all trained from childhood to the use of the rifle. Shooting with rifles, properly adapted to their size and strength, is an exercise which tends to bring out many of the best qualities of boys, as some of you have perhaps seen a day or two ago at Bisley. But what one would hardly imagine is that it has sometimes a powerful moral effect for good on a household. One street boy won a prize at Bisley, and from that moment his home changed for the better, because the pride his father and mother took in him enabled them to become sober and industrious, and live up to

the level of what they thought their boy had attained. If boys are trained to shoot, many of them will, I think, when they leave school, join the ranks of the volunteers instead of becoming hooligans. Moreover, if they once get a liking for shooting they will not become intemperate, because intemperance would make their hands unsteady and spoil their chances of successful aim."

Three lectures were given to the Congress as a whole, of which one by Bishop Welldon on "The Effect of School Training on Mental Discipline and Control in Adolescence" appealed to all, and was listened to with great attention. The others, by Dr. Doleris, of Paris, on "Les Sports au point de vue de l'Hygiene chez la Femme et la jeune Fille"; and on "The Relations between Medicine and Pædagogy," by Professor Griesbach, of Mulhausen, were of a more special and technical character. Dr. Welldon spoke from his forty years experience as a schoolmaster, dealing chiefly with general principles. He quoted Kant and Locke as to the humouring of children. Kant wrote: "The custom of nurses and mothers to hurry to a crying child and sing to him, &c., is very injurious. This is usually the first spoiling of the child; for if he sees that he obtains everything by crying for it, he crys all the more." As to corporal punishment, it is, he says, "indeed dying out in English schools; and, by a curious paradox, it lingers in the schools of the rich when it has been abolished in the schools of the poor. How touching a sign of the times it is that Mr. Charles Booth in his house-to-house visitation of the streets in the East of London, should have come upon a man who described himself as a vendor of canes, reduced to poverty by the abolition of corporal punishment in the board schools!" Dr. Welldon says: "At whatever cost, the habit of unquestioning obedience must be created in the young. When I was headmaster of Harrow School, I used to say to my colleagues, 'Begin by making the boys feel that you are prepared, if need be, to grind them to powder; then you may safely grant them as much liberty as you will.' The quality which affords the best promise of success in the teaching profession he would call 'sympathetic severity'—the absolute strictness which is yet recognised by pupils as being the basis of a tender heart, like a rock with sunshine playing upon it." Selfishness he considers to be the most frequent and potent of the moral causes which blight the child's character: "Unselfishness is the result of disciplined habits, and the habit is one which needs to be encouraged in every house as well as in every school." It is possible that education itself has been made a little too easy. "All true education," says Professor Sadler, "involves and is the better for sacrifice." This must be deliberate and habitual; early rising, punctuality, plain living, high thinking. Long ago Locke complained that "Most children's constitutions are either spoiled, or at least harmed, by cockering and tenderness"; what would he have said to the heated rooms, the luxurious accommodation, the richly

furnished tables of some modern fashionable preparatory schools? "There is certainly," says Dr. Welldon, "greater temperance in drinking among public school boys now than in former years"; but he is afraid that this is more than balanced by indulgence in eating. He is rather against the present prize-seeking motive that prevails in educational systems. It seeks the reward of learning, not in the learning itself, but in the honour attached to it. The whole idea that a person should do his duty, and should do it, if need be, at great personal cost and without any anticipation of reward, is alien from modern educational theory. But the desire of beating others is not a motive which generally needs to be encouraged; ambition has been the scourge of human history, and it has been a surprise to Dr. Welldon that schoolmasters and mistresses should show so little scruple in proposing ambition as an object to their pupils. The lecture concluded with a comparison of the patriotism of Japan—where the Rising Sun waves in the breeze upon every tramcar, and in the schools the veiled portrait of the Mikado hangs upon the walls —with that of ourselves, who "are but now beginning to appreciate the spell which the national flag, displayed as a symbol on school buildings, may exercise over ardent youthful spirits." Dr. Welldon's address was equally full of sober wisdom and pleasant humour, and was received with much applause.

There were four set discussions for the Congress as a whole; the first was on School Work in its Relation to Duration of Lessons, Sequence of Subjects and Season of the Year; the second was on the *Lighting and Ventilation of Class-rooms.* This latter was introduced by Sir Aston Webb, who was followed by Messieurs Courtois and Dinet, and Professor Wilhelm Prausnitz.

Sir Aston Webb stated at the beginning of his paper that he claimed no originality for his remarks, merely recording his own experience, and what he believed to be the present practice in England. With reference to the size of class-rooms in regard to lighting and ventilation, the Board of Education's regulations determine the area but not the shape of the room. Sir Aston considers that the nearer the room approaches a square the better; with the limitation that it can hardly be lighted satisfactorily if it is wider than 24 feet, while 22 feet width is better; for height 12 feet is generally sufficient, though (for a large number) 13 or 14 feet may be necessary. It is assumed that the lighting "is, as it should be, from one side only"; and again, "it seems hardly necessary to mention that it should be lighted from the left hand of the scholar only."

As regards aspect, it was advised that class-rooms should be so placed that they have sun in them during part of the day, but not always; north, west, and south-west, if unprotected, should be avoided. From the point of view of health, everyone will agree that a north aspect should be avoided; but if the only reasons for avoiding west and south-west aspects

be that they are too sunny (and it is difficult to see what other reason can be advanced), probably most hygienic authorities would consider that we do not, as a rule, have too much sun in this country; that any excess can be overcome sufficiently by blinds; and that to avoid a west or south-west aspect might involve choosing one towards the east or north-east, which would be cold and comparatively cheerless. Of course, in an exposed situation a south-west aspect might be too wet and too windy.

Sir Aston Webb alluded to the importance of the class-rooms being thoroughly "aired-out" between each class; but in his description of the window arrangements he did not appear to contemplate the provision of any windows at all in the wall opposite to that in which are placed the main lighting windows. It would be impossible to flush out a school-room with fresh air, if there are windows only on one side. He seemed to speak uncertainly in regard to the heating and ventilation. He admits that there is much to be said for the open fireplace and open window in *small* schools; but for larger ones this system is impracticable. He recommends either mechanical extraction of foul air at the ceiling level, with hot water radiators under the windows, fitted with bafflers, behind which the fresh air is admitted; or propulsion of warm air into the room by a fan, the air being admitted about two feet below the ceiling. "Each system has its advantages, according to the size and special circumstances of the building, and with mechanical means now so readily at our disposal there should be no difficulty in providing either the temperature or change of air" that may be necessary or advisable. Unfortunately, in practice there does seem to be great difficulty in attaining this result, *i.e.*, in securing fair purity of air in combination with a suitable temperature.

Dr. George Reid adduced the Staffordshire experience, which showed that, from a lighting point of view, it was quite satisfactory to have windows on opposite sides; with this arrangement adequate ventilation could be obtained without mechanical means. "Year by year we are becoming less afraid of fresh air, and a school which complied with open-air conditions as far as possible was the ideal type for the future."

Messieurs Courtois and Dinet consider it impossible to lay down fixed rules for the orientation of class-rooms; but for France in general prefer an aspect between north-west and north-east, the lighting being from two sides, but derived mostly from the best lighted aspect (whichever it may be). They admit the importance of ventilation by the open window, but do not believe that it is always possible to carry it out, and therefore recommend mechanical means; renewal of the air of the class-room being effected three times an hour.

The third set discussion, on *The School in Relation to Tuberculosis*, was introduced by a short but admirably condensed paper by Dr. Newsholme, who dealt with the question from the following standpoints: (1) Whether tuberculosis is spread in elementary day schools, and to

what extent; (2) whether the conditions of life and work in such schools tend to bring into activity latent tuberculosis; and (3) as to such schools considered as important means for teaching and training children so that we may obtain the aid of the next generation in the rapid elimination of this disease. To begin with, Dr. Newsholme showed that tuberculosis of all kinds is, as a fatal disease, relatively uncommon at school ages (5 to 15); also that pulmonary is of less frequency than other forms of tuberculosis at these ages; whereas from 15 years onward pulmonary tuberculosis accounts for the vast majority of all tuberculous deaths; it being granted that, as a means of spread, the pulmonary form is far and away the most important (expectoration, spray infection), also that there are constantly ten non-fatal cases for each annual death. Dr. Newsholme calculates that there are not more than about three in every thousand children attending elementary schools suffering from this form of the disease. From the results of actual examination it appears that there is not, on an average, more than one in 300 "showing revealed or diagnosable" pulmonary tuberculosis. It is not, therefore, likely that there is much spread of infection from scholar to scholar; teachers and caretakers are more likely sources.

Latent tuberculosis is nearly always non-infectious, but is undoubtedly frequent in children (the offspring of consumptive parents), and has important bearings on school hygiene. With a view to prophylaxis as regards these children there are two procedures available; the children may be removed, temporarily or permanently, from their own homes to homes or schools at the sea-side or in the country; or the consumptive parent may be treated in an institution. Dr. Newsholme holds that, if there is a choice, "the balance of good lies on the side of measures directed towards removing the patient himself [*i.e.*, the parent] rather than of measures for removing the children from the domestic circle." The principal preventive measures as regards schools may be summarised as follows: (1) Medical examination of children on admission, and afterwards periodically; (2) exclusion of children with revealed tuberculosis; (3) special care as to feeding and general hygiene of children from tuberculous families, including avoidance of fatigue; (4) frequent wet cleansing of schools; (5) reduction of overcrowding; (6) improvement in ventilation and warming; (7) attention to personal hygiene, particularly adenoids and carious teeth; (8) examination of teachers and caretakers, and avoidance of voice-strain and over-fatigue by the former.

Thirdly, Dr. Newsholme says truly that "public opinion is formed in the schools; and if each teacher and scholar is taught to practise the laws of health, a much more rapid decline of tuberculosis can be secured." Domestic infection is of supreme importance; if good habits are inculcated as to coughing, expectoration and scrupulous cleanliness, and knowledge

is obtained as to the relative value of foods, and the dangers of alcoholic drinks, the school will be a valuable aid in preventing tuberculosis.

The fourth set discussion was on *The Examination of School Children.* Dr. Leslie Mackenzie, Medical Member of the Local Government Board for Scotland, detailed the objects and extent of this examination, emphasising the points, that it is not possible "to separate the personal examination of the child from the examination of his home environment; that "when the three primary facts—occupation of parents, size of house, and number of inmates—are recorded, the school becomes an important connecting link between the public health authority, the poor law authority, the police authority, and the education authority"; and that "the school is always the largest single depôt of public health material we have access to." He attaches great importance to the part played by the teachers in this examination, and testifies to the readiness and competence of the teachers in Scotland in regard to it. He is inclined to use the existing public health service for the work, and has little doubt "that, at least in Scotland, the authorities for public health and the authorities for education will amalgamate their medical services until it will be impossible to draw a line between the health service and the medical service of schools."

Dr. H. Méry, Professor in the Faculty of Medicine in Paris, presented a report, detailing a standard method of examination, and called on the Congress to constitute an International Commission for the collection of information and the establishment of standards of anthropometric data, &c. His propositions were, shortly, that the examination should be in three parts: (1) Weight, height, and thoracic measurement; (2) hearing and sight; (3) general body condition—skin, hair, teeth, circulatory system, and especially the lungs and the vertebral column. Abnormal children should be examined more particularly; normal children should be measured half-yearly. Dr. H. Kokall, of Brunn, described the methods of examination of school children in that city and furnished statistics of the principal defects observed.

The proceedings in Section I., which was concerned with the *Physiology and Psychology of Educational Methods and Work*, opened with a characteristically eloquent and interesting address by Sir J. Crichton Browne, on "Mind, Brain, and Education." The subjects dealt with in the papers varied much in scope. Professor Sully discussed the "Bearing of Schoolwork on Healthy Mindedness"; the Headmaster of Eton drew a "Comparison between the Training given by Classics and Modern Languages" (the meaning is plain, but surely the form of expression is open to criticism). There were papers on many topics; and in particular, a plea for return to the method of sloping writing by M. Desnoyers, of Paris, who maintains that, although when sloping writing is done with

the book in the same position as for vertical, then the body has to be twisted; nevertheless, if the book is twisted, then the body can be kept straight. The straight position is more easily maintained than with upright writing, as there is less displacement of the right arm. This view does not seem to have elicited criticism or to have met with acceptance. In Section V., however, Dr. Gagnière read a paper on the same subject in its relation to curvature of the spine. He recommended a sharp look-out for the early signs of these curvatures, a curtailment of work in the sitting position, and the use of a seat that would reduce to a minimum the flexion of the thighs on the pelvis; but he did not consider that the method of writing, either vertical or inclined, had any preventive action against the development of curvature.

Professor C. S. Myers, of King's College, spoke on "School Fatigue." It is most apt to occur among slum children who receive insufficient sleep and food, the former cause being the more important, as seen in children who are wage-earners out of school hours: they do worse at school than the other children; while children coming hungry to school do not do worse. He believes that the average elementary schoolboy does not get sufficient sleep. Dr. Baur, of Wurtemberg, described the measurement of fatigue in children by "Scheiner's experiment." Two fine holes, about the width of the pupil, or less, distant from each other, are made in a card with a needle. The eye, held closely to the card, observes the point of a pin, looking at the same time through both holes, at a distance of about 20 cm. Within the limits of accommodation the pin's point appears single; when approached nearer, or removed farther, the eye will see it double. The more perfect the power of accommodation, the nearer to the eye will the pin appear single; or, the lower the accommodation sinks, the further must the pin be removed, in order to be seen single. The investigation can be done in one minute. Miss Ravenhill gave the results of an enquiry into the hours of sleep of 9,000 elementary school children; whereas the standard allowance should be thirteen hours at 7 years of age, falling steadily to eleven hours at 13, the actual hours of sleep were—for boys, eleven hours at 7, falling to eight hours at 13; and for girls, eleven hours at 7, falling irregularly to nine hours at 13.

Professors Myers and Edgar corroborated Miss Ravenhill's statements, and emphasised the importance of the enquiry; deficiency in sleep is one of the main causes of physical degeneration. A distressing paper was read by Professor Chlopin, of St. Petersburg, on "Suicide and Attempts at Suicide in School Children." Dr. J. C. McWalter spoke on "Physiological Sins and a Health Conscience," a short but important contribution, from which a sentence may be quoted: "Ideas of parental duty are being rapidly recast; and fathers and mothers, who are now inclined to deride us as faddists because we insist on medical inspection of schools and scholars, will shortly be called on to render a terrible account to their

offspring who find themselves the victims of defects of vision, or hearing, or health, or of deformity, which the parents could have had corrected, if they had listened to our warning in time. Nothing is more certain than that in a few years children will demand satisfaction from their fathers for every evil or inconvenience from which they suffer, and which might have been averted by timely care." When, however, Dr. McWalter states that "It is a physiological sin to build a school, or to inhabit one, on a damp clay soil," we should like to ask him where we are to build it, if we live on a clay formation. A school air-ship at anchor would appear to be the only alternative, but this can hardly be intended. A short paper by Herr Roller, of Darmstadt, should send many teachers and school doctors to a study of John Locke, who in the seventeenth century devised a practical code of school hygiene, well worthy of attention at the present day.

Section II. of the Congress was concerned with *Medical and Hygienic Inspection in Schools*. Professor Osler presided, and opened the proceedings with a few introductory remarks, pointing out the difficulties of the subject, acknowledging that we are far behind Austria, Sweden, the Argentine Republic, Hungary, Norway, Switzerland, Servia, France, Japan, Roumania and Russia; in all of which countries medical inspection is in force by legal enactments, which have come into operation in the several countries, in the order named, between 1873 and 1889; and defining the ideal conditions, viz., first, a central department at the Board of Education, which would supervise and co-ordinate work throughout the country; secondly, at each school, an intelligent woman, preferably one who has had experience as a nurse, who would carry out anthropometric observations, and assist the doctor in matters relating to the hygiene of the school and of the children; thirdly, the school dentist, who would make a quarterly inspection and put the teeth in order; and lastly, the school doctor.

Thirty-one papers were contributed to this Section, a larger number than in any other. Most of these papers, and the discussions arising from them, referred to the following points: the relations between the teachers and the newly appointed school doctors and nurses; the scope and methods of medical examination of children, especially with regard to the teeth and the eyesight; treatment at school; school anthropometry.

Dr. Hayward, of Wimbledon, strongly advised enlisting the active co-operation of the teaching staff in regard to the medical inspection: "The doctor should invariably, before an inspection, interview the head teacher and arrange his work as best suits the convenience of the school. He should receive a general report as to the health of the scholars and the hygienic arrangements, and discuss any points of difficulty or doubt." He considered that "the efficiency of an inspection and the results obtained are almost entirely dependent on the attitude of the class teachers and the share of zeal with which they enter into the work." He found

that the keeping of a medical class-book in each room was a great help in an inspection; the teacher would enter beforehand the cases to be brought forward, and any points on class-room hygiene, appliances, &c. A personal interest and pride in the physical welfare of the children should be initiated at the training colleges for teachers, especially for men teachers who have not the same instinct for this kind of work as women. With regard to infectious diseases, Dr. Hayward considers that a large responsibility must fall on the teachers; they have their classes under constant observation, and can, with a little training, become acquainted with the prodromal symptoms of the ordinary infectious complaints and take the necessary steps for excluding any suspicious case. As to cleanliness, he says that the attitude of the teacher and the zeal of the nurse are the real factors in securing results. When they are keen, the children are clean, and a high tone in this respect is maintained. The weak point in medical inspection, after all, lies in the fact that it brings to light conditions over which we have very little control; a well-trained nurse, however, can do much by instruction and influence. In the discussion there was a general agreement that a cordial and sympathetic co-operation between the school doctor, the teachers and the nurse was essential.

Mr. J. W. Willis Bund, Chairman of the Worcestershire Education Committee, one of the most experienced and progressive of the non-medical authorities on public health and education in this country, contributed an exceedingly practical paper, in which he laid stress on the point that thorough inspection means economy for the ratepayers for two reasons: (1) the amount of the Government grant depends on attendance; (2) the attendance can only be kept up by keeping the children free from infectious complaints. Abnormal children should be separated and properly treated as far as possible, for "if these abnormal children are allowed to grow up without some attempt at cure, it means that it is only a question of at what time in their lives they will have to be included in the class supported by the rates. Taken young, it is possible that they may never come upon the rates, but be able to maintain themselves; left to develop their abnormal tendencies, they will certainly at some time cease to be able to maintain themselves even if they can temporarily do so." It is the proper application of this *argumentum ad crumenam* that really forms the basis and justification for the whole system of medical inspection of school children. Of course it is costly, but it is money well laid out, and will result in a saving in the long run.

The medical supervision of schools in Sweden was described by Dr. Gottfrid Jornell. Besides the ordinary duties as now generally understood, it is the duty of the medical officer to attend indigent children free of charge, and to spend at least one hour per week on the school premises for the purpose of offering advice, if it be needed, to the masters or pupils.

Mrs. Watt Smyth gave an account of the system of inspection in

Bulgaria, which, as regards secondary schools, she considered might be copied with advantage in England. "It was interesting to note that during the past three years in the girls' secondary schools at Sofia no case of infectious disease from among the day scholars had got further than the doctor's consulting-room, and there had been no cases among the boarders. This shows what immense benefit can result from careful inspection.

The special subject of *Children's Teeth* was dealt with by Dr. Edward Wallis, and by Professor Jessen, of Strasburg. Dr. Wallis gave the results of his inspection of the Michael Faraday London County Council School, Walworth. Out of 245 children between 7 and 12 years of age that were examined, only four were found to have the normal number of healthy teeth; only three possessed tooth-brushes of their own and used them regularly; these three were practically free from caries. The teeth of most of the remaining 242 were coated with tartar and the *débris* of past carbohydrate meals and bacterial growths; 62 per cent. of the children had chronic enlargement of the submaxillary glands, due in great measure to the oral sepsis that existed in so many of them. "The condition of the teeth of these children, that is to say, the children of an ordinary representative school in a poor district, is so bad that not only are they suffering from their purely dental affection, but owing to the secondary effects produced by these affections, their bodily nutrition is impaired, and their physical and intellectual development hindered." Dr. Wallis's chief remedial suggestions are: First, to obtain the co-operation of teachers and parents, to give instruction in care of the teeth as part of the general curriculum in training colleges and pupil teacher centres; also in evening schools, where the management of children is dealt with. A simple object-lesson is suggested—viz., to show that a tooth soaked in vinegar becomes so soft that it can be cut with a knife; this demonstrates the ill-effects of pickled cabbage, an article of diet that is working havoc among the teeth of the factory girl class. The need for, and right way of using, a tooth-brush should be explained. There are many difficulties, and Dr. Wallis thinks that the only possible plan is for each child to be provided with a numbered tooth-brush, to be kept at the school and used on arriving morning and afternoon. Finally, the greatest difficulty is the treatment; how to deal with half a million children, of whom about 90 per cent. require dental treatment of some kind. The appointment of school dentists seems to be the only course possible. The existing dental hospitals and dental departments of general hospitals are totally insufficient for the work required.

Dr. Jessen gave an account of the work of the Municipal School Dentistry at Strasburg, founded by combined private and municipal effort—the first institution of its kind in Germany. He said that "in Germany, at the present moment, at least 90 per cent. of all elementary school children suffer from decayed teeth. In some districts with plenty of chalk the

percentage of decayed teeth is somewhat less. In a large number of towns it rises to 95, 96, and 97 per cent." The number of children treated in the four years 1902-1907 increased yearly, and the cost increased from £115 to £450; but "in no part of the public medical service have such results been obtained with such small expense." The work of the children improved, also their general health. The attitude of the teachers was most sympathetic. The children took the greatest interest in the instruction given them about the care of their teeth, and "liked to be treated by the dentist" (*sic* in original). The benefits of the school dentistry are experienced by the children at once; the advantage to the community can be demonstrated in the course of a few years.

Dr. Wright Thomson recorded the results of his examination of 52,493 children, mostly of working-class parents, attending Glasgow schools, as to their acuteness of vision. He found that 35 per cent. had vision below the normal; 14 per cent., although unable to see well, had nothing apparently wrong with their eyes; the defect seemed to be functional. He found that in country schools the vision was much superior. He advised that in the infants' department an effort should be made to provide definite visual training, and that sewing and all other work involving close use of the eyes should be abolished.

In Section III., dealing with the *Hygiene of the Teaching Profession*, Dr. Macnamara, M.P., gave the Presidential Address, in which he insisted on the necessity for free ventilation of the school-rooms ("the air should be changed at the middle of each session just as regularly as the registers are marked at the opening"); deplored the practical difficulties involved in opening the windows, as in schools facing on noisy thoroughfares, where the teacher's "human voice is all day long in hopeless competition with the incessant and relentless uproar of rumbling drays, rattling omnibuses, jangling tramcars, and groaning motor-'buses"; and urged on all teachers that they can be most impressive when they speak most softly. Lessons should be given in the open air as far as possible during the summer months. Provision should be made for the teacher, particularly the woman teacher, to sit down from time to time. He urged that the teacher, unless it was absolutely imperative, should resolutely decline to take his work home with him at night; recommended athletics in due moderation, especially golf; and advocated travel as the best way of taking a holiday. It would be a good thing if this short, common-sense address could be read by every elementary school teacher throughout the country.

Mr. Walter Todds gave statistics of the diseases incidental to the teaching profession. Influenza, throat complaints and chest affections are the most frequent causes of illness; while breakdown chiefly results from nervous diseases. Dr. Hulbert spoke on the care of the teacher's voice; and declared that "voice-production," that is, "the physical education

of the muscles of the vocal apparatus directly, and indirectly of all those muscles of the body which help the vocal muscles either directly or indirectly—therefore, physical education generally . . . . is the one and only remedy for the loss of the voice-user's voice." Dr. Permewan believed that one cause of voice trouble in school teachers was the pernicious habit of holding several classes in the same room. Mr. T. W. Williams said that the first necessity of voice-production was "deep breathing."

Sir William Collins presided over Section IV., dealing with *Instruction in Hygiene for Teachers and Scholars*, in which papers were read by Professor Carstairs Douglas, of Glasgow; Mr. K. A. Knudsen, State Inspector of Gymnastics for Denmark; Dr. Helen Putnam, of Providence, Rhode Island, and others. A resolution was passed "That all schools having courses for the training of teachers should give instruction in (*a*) personal and school hygiene, and (*b*) the principles and practice of physical training; and that to each of these subjects should be given as much time as to the major subjects in the course." Another resolution was carried, "That this Section is of opinion that the principles and practice of hygiene should form part of the education of every citizen."

(*To be continued.*)

Lecture.

THE SANITATION OF THE FIELD AMBULANCE.[1]

By Major E. C. FREEMAN.
Royal Army Medical Corps (R.).

The practice of sanitation in the field ambulance is favoured by the knowledge of the principles of hygiene which is (or should be) possessed by every member of its *personnel*. It is, however, much more difficult to carry out efficiently than in the case of an ordinary camp, because in addition to the drawbacks common to all military camps, the field ambulance will contain sick and wounded, and these often in sudden and overwhelming numbers. Yet in no part of the system of the Field Army is good sanitation of more absolute importance, for without it the field ambulance will rapidly become a pest-house to its patients and a centre of contagion to the force to which it is attached. Look, for example, at accounts of hospitals in the Crimea.

[1] A lecture delivered to officers attending the East Anglian School of Instruction, R.A.M.C.T.

During our peace training we are apt to forget that on service the field ambulance will always be either preparing to receive sick, filled with sick, or evacuating the sick—the term "sick" being here used to include both sick and wounded men. Consequently drills and exercises without sick men are merely drills and exercises; while the annual treatment of cases of actual illness and injury is of the same supreme importance to medical units as range practice is to batteries of artillery. It is for this reason that our field ambulances will always go into camp with one or other of the infantry brigades in order to actually carry out the treatment and sanitation of the sick in the field.

The principles of hygiene are the same in the camp hospital as in any other camp, but they need to be carried somewhat further, and to be still more carefully applied.

We may classify them thus:—

(1) Provision of pure air, pure water, pure food.

(2) Prompt removal and destruction of all excrementitious matter.

(3) Separation of the healthy from the sick.

(4) Classification of the sick.

The difficulty lies in the application of these simple principles. Sometimes, no doubt, in times of stress—of forced marches and great battles—everything for the moment must give way to the immediate treatment of the wounded at any given spot and under any conditions. These conditions, however, should last for a few hours only, and next day perfect order and system should again be in evidence, which can only be effected by thorough training, discipline, and organisation.

It has been laid down that the Territorial field ambulances will carry no tents on active service. Therefore, buildings will have to be requisitioned, and here comes in the question of pure air. Avoid especially any buildings which have been occupied by troops or used as a civil hospital. Choose public halls, schools and large sheds, barns and workshops, because these are ventilated. Avoid churches because they are cold, ill-ventilated, and generally surrounded by graveyards. Private houses are as a rule too small, except to receive officers, who are best treated alone or in small parties. Try to secure 1,000 cubic feet of air at least for each of your patients. Spread out your sick as far as possible and never allow overcrowding.

A good water supply will be a principal factor in the choice of the site for your field hospital. The importance of pure water has already been dealt with in previous lectures. If the supply is from waterworks or otherwise reliable, protect it by water police from contamination, and arrange for it to be handled as little as possible in transit from tap or well to consumer.

If you think there is likelihood that the water may be infected by typhoid germs you must boil or filter it as circumstances direct. It is necessary in this case that the men on "water duty" should not come

in contact with the sick, or they may convey pathogenic germs to the very water they are carefully sterilising. Sterilisation by heat seems most suitable in the field hospital, as hot boiled water will be required in any case in large quantities for surgical purposes.

Field ambulances are "non-dieted," and the sick cannot eat tinned beef, so the principal articles of diet for them are "medical comforts," *i.e.*, tinned milk, soups, biscuits, tea, chocolate and alcohol. It will be necessary to inspect these things to see that they are good brands and in good condition, and that all the cups and utensils they are served in are cleaned with boiling water.

It should be noted that food, such as milk or soup, must never be left uncovered in the sick ward to form a nutrient medium for germs. It is very necessary to supervise the cookery for the sick to make sure that it is properly done and that the food is served hot and in good order to the patients. Nothing is so repugnant to a sick man as glasses of curdled milk or cold, grease-covered soup.

This leads us to the temporary kitchen, which must be carefully watched to see that it is kept perfectly clean and free from all organic waste, which is to be at once burnt to avoid attracting flies.

For this same reason, whenever possible, the transport arrivals should be kept at a distance from the hospital, as they most certainly attract flies and insects, and so tend to spread infection. Vehicles should also be prohibited from entering the camp and should unload outside, and if the ambulance is supplied with "meat on the hoof," all butchery operations must be conducted as far off as possible, and with scrupulous cleanliness as to burial of offal, &c.

All excrementitious matter must be removed from the neighbourhood of the sick as quickly as possible. For this purpose the orderlies must be most carefully trained to remove at once and burn all soiled dressings and discharges, and not, as they are apt to do, to leave them "for a more convenient season." All excreta must be got rid of in the same way, but here considerable ingenuity will be required in improvising temporary latrines and rough close-stools. For these and similar purposes it is very desirable that two or three of the *personnel* of the ambulance should be carpenters and tinsmiths by trade.

As it is probable that there will be typhoid and dysenteric cases among the sick, the ultimate disposal of the excreta becomes a most important question. In the light of recent experiments, disinfection by any ordinary disinfectant solution is, in practice, of very dubious value. Destruction by burning after mixture with straw or any other inflammable rubbish is best. Boiling is efficacious if it can be properly carried out, and trench burial, with a warning notice on the site, is our last resource.

If trenches are used, they must be placed well away from water supplies and cooking places, yet not too far away to be of use. They should be deep, as the risk of placing typhoid material in shallow trenches

is too great to be lightly undertaken. It is also of the greatest importance that flies should be kept away by the use of earth or lime thrown at once upon the dejecta.

In disinfecting utensils, boiling water or izal may be used; if the latter, care must be taken that all traces of the disinfectant are removed and not left to burn the skin of the next patient—a too frequent accident. Izal, creolin and the "sheep-dip" class of disinfectants are the best on active service. Corrosive sublimate is useless with the galvanised iron pails supplied, and both it and carbolic acid are too poisonous to be safe under service conditions.

To preserve the health of the hospital *personnel* is of the highest importance, as trained orderlies are not easily replaced on service. For this purpose absolute separation from the sick is essential. Separate latrines and cooking places must always be made; the orderly must never take his food with or near the sick. Before entering the ward he must wash his hands for the benefit of the patients, and before leaving it he must do so again for the benefit of himself and his comrades. For the same reason it is most desirable that he should be provided with a stout holland blouse to put on when entering the ward and take off on leaving. If an orderly wears his uniform without any washable covering while engaged with the sick, he is almost certain to carry pathogenic germs to his comrades. It is to be hoped that washable blouses for the purpose will be issued by the War Office. Men employed as cooks or on water duty must never enter the wards, and men employed on ward duty should spend as much time as possible in the open air when off duty.

Whenever the hospital is empty, opportunity should be taken to clean, air, and disinfect all blankets, and to wash and scrub all utensils used in the service of the sick, so that there shall be no risk of infection being passed on.

Surgical and medical cases must be strictly separated, and of the former all those who present the least sign of septic infection or erysipelatous rash must be isolated and treated apart from the others. Venereal cases must also be kept rigorously apart, lest infection spread to other patients. Infectious cases which can safely be treated among other patients in an ordinary hospital must be isolated in the field, where the patients are so intimately mixed together, and the necessaries for cleanliness are so often wanting.

On the medical side, besides isolating all cases which we isolate in civil practice, it would be advisable to treat, in separate buildings when possible, all cases of pneumonia and tubercle and all bowel complaints. These latter cases will always be a great source of anxiety on service, as with them lie the chief potentialities of infection to the whole force. A long paper might be written on this point alone, but here it must suffice to say that, if in doubt, it is better that six cases of diarrhœa should be needlessly sent back to the base, than that one mild case of ambulant

typhoid should be returned to duty to spread disease among the troops in the fighting line.

The same remarks apply with equal force to dysentery, but here examination of every case complaining of the disease should enable us to separate at once those suffering from hæmorrhoids and local troubles from the victims of the more serious disorder. This simple precaution is often overlooked in the rush of work in the field.

Besides these, cases of acute skin disorders, ringworm, and all staphylococcal infections should be separated and sent to the base, even if able to perform military duty, as the risk of such infections spreading and becoming aggravated in camp life outweighs the advantage of the individual man's services.

The foregoing notes apply to the field ambulance when moving with troops. If halted for any length of time the hospital camp should be carefully prepared. There should be separate washing places for the sick and for the orderlies, with overhead shelter and suitable arrangements for the disposal of the waste water, either by trench or soakage pit. The latrines should be elaborated, and indicated by whitewashed stones by day and lamps by night. Destructors should be built for the consumption of rubbish, and improvised beds made to keep the sick off the ground in the wards; while the necessary ward furniture can be made from empty cases and kerosene tins obtained from the Army Service Corps. Disinfection of the patient's clothing should also be attempted, and for this purpose tubs of boiling water should be used, or wherever locally available a steam disinfector should be pressed into the service.

In this lecture stress has specially been laid on "contact infection," because the experiences of the American troops in the Cuba war, and our own experiences in South Africa, tend to show that contact is the chief mode of dissemination of enteric fever and dysentery in war, when men are huddled together in tents or buildings; while water pollution is the usual agent under the normal conditions which obtain in peace. It is possible that the immunity from enteric fever enjoyed by British troops in South Africa while on flying columns, was due to the absence of tents; and that the good health of the Japanese in the Russo-Japanese war was as much connected with their hot baths and personal cleanliness as with their special care for their water supplies.

These considerations will, it is hoped, lead you to consider and work out for yourselves the many important problems connected with the sanitation of the field ambulance, so that in this direction the medical field units of our division may be fully prepared for active service.

Reviews.

THE PLANNING OF FEVER HOSPITALS. By Albert C. Freeman, M.S.A. Pp. 162. The Sanitary Publishing Co. 7s. 6d. net.

This book may be divided into four portions:—

(1) A *résumé* of the various Acts and Amendments dealing with the prevention of infectious disease, arranged in chronological order.

(2) A series of chapters dealing with site, accommodation, ventilation, heating and sanitary appliances. A short chapter on the construction of temporary isolation hospitals.

(3) The major portion (some 100 pages) contains descriptions of various fever hospitals and a great many plans are given. A table of the cost per bed of several hospitals is included.

(4) Deals with disinfection, personal cleansing stations and reception rooms, and more plans are given. There is also a chapter on disinfectors.

The book should be of use to those concerned with the planning and construction of fever hospitals; it is, however, a matter of regret that the revision before final printing was not more thorough (*vide* first sentence on p. 21, which has no meaning, and contains various figures not explained in the text). The description of appliances is limited to particular makes, and it is unfortunate to find that several of those figured or recommended may be again met with in the advertisements at the end.

G. E. F. S.

TRAVEL AND EXPLORATION. Witherby and Co. 1s. net.

The February number is the second of this new monthly magazine, which numbers amongst its contributors Colonel Sir T. Holdich, F. C. Selous and A. R. Colquhoun.

The first article is by Sir T. Holdich, who, in describing Dr. Sven Hedin's work in Central Asia, speaks of him as the apostle and exponent of the recognised form of modern exploration—the scientific observation of every new feature encountered. The great secret of Sven Hedin's success is that he devoted years to careful preparation for his life's work in such varied departments as geography, archæology, ethnography, history, botany, geology, and even sociology, added to which his command of languages is extraordinary.

Mr. Selous gives many practical suggestions for the sportsman's outfit in Central Africa, both as to firearms and camp and personal equipment. For hunting on foot, he says that very thick red rubber soles stitched on to leather are more noiseless and durable than any other kind of footgear.

Mr. A. R. Colquhoun reviews Lord Ronaldshay's book, "A Wandering Student in the Far East." In it we read of the condition of industry in modern Japan. Children of ten or twelve toil all day in the factories, women work fourteen hours at the loom for a fraction of a penny an hour, and men earn five or six shillings a week for a twelve hours' day. On what reserve will Japan be able to draw when she has thus demoralised and devitalised her splendid peasantry?

Other articles wander from Morocco (E. Ashmead-Bartlett) to the West Indies (A. Aspinall) and from Ski-ing in the High Alps (Arnold Lunn) to the Veddes of Ceylon (Dr. Seligmann). All are illustrated, and there are several sketch maps.

At the end there are sections devoted to travel literature, exploring enterprise, and tourist travel.

J. T. C.

HANDBOOK OF THE MEDICAL SERVICES OF FOREIGN ARMIES. Part II. Germany. Pp. 167. London: Harrison and Sons, 1908. Price 6d.

Part II. of this series, prepared by Lieutenant-Colonel W. G. Macpherson, C.M.G., R.A.M.C., deals with Germany, and is issued in continuation of the plan recently adopted of publishing descriptions of these services in separate, and therefore more readily revisable, parts.

The first portion of the book contains a historical sketch of the development of the medical service of the German Army from early times, and mentions the causes which underlay the various phases of its evolution.

It then goes on to describe the medical organisation as it now exists in time of peace, dealing with the training, administration, distribution, and duties of the *personnel*, and the sources from which it is derived.

Chapter III. deals with organisation for war, and gives a detailed account of the composition and functions of the various medical units, and describes the medical equipment, field stores and technical transport in use.

The last chapter shows the extent to which voluntary aid to the sick and wounded is organised in Germany, and the preparations made for its employment on mobilisation.

The appendices include tables of *personnel* and equipment, and a vocabulary giving the English equivalents of terms employed in regulations affecting the medical service.

E. T. F. B.

Current Literature.

The Vaccine Treatment of Typhoid Fever.—W. H. Walters and C. A. Eaton, of the Boston University, report thirty unselected cases of enteric fever treated with subcutaneous injections of a stock emulsion of *Bacillus typhosus*, sterilised at 60° C. for twenty minutes, and preserved with 0·3 per cent. lysol (*Medical Record*, January 16th, 1909, p. 93); 15 to 70 minims of this were given in no case earlier that the sixth day. Five was the maximum number of injections, but two-thirds of the cases received one or two only. In nearly all a decline in the temperature was noted, confirming Fraenkel's original observations (JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, September 1906, p. 271) on this method of treatment. The authors remark: "In the majority of these patients the effects have been so noticeable, both to the writers and to the attending physicians, that it seems wise to publish them, hoping thereby

that others may be encouraged to apply the same method, and that we may the sooner obtain a more certain knowledge concerning its benefits and limitations."

Two deaths are recorded. In one, a single injection was administered on the thirty-fifth day of the fever. In the other 15 and 70 minims were given on the tenth and thirteenth days respectively. The number of bacteria per cent. of the vaccine is not mentioned. C. B.

An International System of Wheeled Litters. (*Archiv. de Med. et Ph. Mil.*, September, 1908, p. 234, by J. Nord).—This writer proposes the institution of light wheeled litters which, if horses are not to be had, could be drawn by men. These would have the advantage of being cheaper than heavy vehicles, they would not require any special make of stretcher, they would only need one horse, and could be used over all kinds of country. Each would accommodate three wounded lying down and two sitting up. The litter is on two wheels and is divided into two parts, namely, the wheels and the body. The whole body rests on springs and can be moved horizontally along two rails, on which it is mounted in order to get a proper balance. The arrangements for fixing the stretchers in place are so conceived that they always remain in a horizontal position. The shaking due to the movement of the litter is reduced to a minimum by placing the body of the vehicle on springs and by suspending the stretchers from hooks. The litter is held up when at rest by supports which can be let down at will.

The forepart of the frame is provided on each side with a seat for wounded sitting up, so that completely loaded the litter carries five wounded.

The whole body of the vehicle is made of iron and covered with canvas which forms curtains at the sides. It is very easy to disinfect, and would be of use not only in the Army but at police stations. It has been tried with success over bad, uneven and sandy ground, and the five occupants found that they suffered no discomfort from shaking or jolting.

W. G. M.

Standards of Vision in the French and other Armies. (*Archiv. de Med. et Ph. Mil.*, September, 1908, p. 226).—A great number of diseases of the eye, especially those which produce errors in refraction, have little effect on the constitution of those who suffer from them, and are therefore compatible with military service, or at least with auxiliary services. In this article the recruiting regulations of various countries with regard to eyesight have been studied and compared.

The various methods of testing eyesight prescribed in the different armies all point to the importance of good colour vision for military service. The use of mydriatics with short duration of effect recommended in Sweden is an excellent measure and would be of use in the examination of certain deep lesions of the eye.

Acuteness of vision is the most important quality in a recruit's vision, and the standard of acuteness varies in different countries, as the following table shows:—

Country	Regular service	Auxillary services
France ..	$\frac{1}{2}$ for the best eye .. .. .. $\frac{1}{20}$ for the other	$\frac{1}{3}$ to $\frac{1}{4}$ for the best eye. $\frac{1}{20}$ for the other.
Germany ..	Better than $\frac{1}{2}$ for the best eye ..	Better than $\frac{1}{4}$ for the best eye.

Country	Regular service	Auxiliary services
Austria ..	Better than $\frac{1}{2}$ for both eyes; if one eye = $\frac{1}{2}$ and other eye = $\frac{1}{4}$, fitness for service is modified	$\frac{1}{2}$ for the best eye, $\frac{1}{10}$ for the other.
Italy ..	Binocular vision = $\frac{1}{3}$. Not less than $\frac{1}{12}$ for the worst eye.	
Sweden ..	0·8 for the best eye, 0·6 for the other eye, or 0·9 / 0·1	0·3 for the best eye, 1·3 for the other; or 0·6 for the best, and no limit of error for the other eye.
Switzerland	$\frac{1}{2}$ for the best eye, $\frac{1}{2}$ to $\frac{1}{8}$ for the worst if the right eye = 1.	
Belgium ..	$\frac{1}{2}$ for the right eye. $\frac{1}{10}$ for the left eye.	
England ..	$\frac{1}{2}$ for the best eye (?). $\frac{1}{6}$ for the other.	
Japan ..	.. Binocular vision = $\frac{1}{3}$.	
U.S.A. ..	.. Visual acuteness = 1.	

This table shows that in most of the large armies of Europe the acuteness of vision of the regular soldier is fixed at about half for the best eye.

The German regulations say nothing about the value of the other eye, while the French require a minimum acuteness of $\frac{1}{20}$. Those for Switzerland and Belgium specify that the best eye must be the right. In other countries no importance is attached to this point, as the soldier is allowed to shoot from whichever side his sight is best. One-sided sight is favourable to correct shooting, so it seems unnecessary to fix upon the right eye (which is most often the worst) as the best and reject recruits who do not reach the standard prescribed. Such men might at least be enrolled in the auxiliary services, and this would permit a large number of men who are rejected every year for defective eyesight to be enrolled in the ranks.

Among the defects of vision which owe their existence to refraction, myopia is generally allowed, and correction of it is prescribed in all armies except the English and American. It is permitted to a degree of 6 dioptrics in France, 6·5 in Germany, 5 to 6 in Austria, and 7 in Italy, provided that the visual acuteness comes up to the standard. All regulations except the Italian recommend the use of corrective lenses.

Hypermetropia is permitted in the French, German, Austrian and Swedish armies, but the recruit is made to wear glasses to correct the error. In Italy the use of convex glasses is forbidden. In the Swiss Army hypermetropia up to 4 dioptrics after correction is permitted.

The correction of astigmatism among the men by use of cylindrical glasses is only permitted in Germany. In the Swiss Army it is allowed for officers, but only if the acuteness of the best eye reaches $\frac{1}{3}$. In all the other countries cylindrical glasses are not permitted, and astigmatic recruits are only accepted when the error is not great.

Strabismus is treated in various ways. In France, only the acuteness of vision of the two eyes separately is taken into account; in Germany a moderate deviation of the eye is permitted. As a matter of fact, in the greater number of cases strabismus is caused by amblyopia of one eye,

and it should be considered as belonging to the category of blindness of one eye.

The conclusion to be drawn from all these facts is that the acuteness of the best eye only should be taken into account. Men even when they are incapable of seeing with both eyes are perfectly capable of performing their military duties, or they can at least be employed as drivers for Artillery or Army Service Corps wagons.

The regulations concerning other diseases of the eye are, with the exception of a few details, the same for all armies. W. G. M.

Correspondence.

THE USE OF IODINE AS A SKIN DISINFECTANT.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—May I place on record the perfectly satisfactory results which have followed the use of iodine as a skin disinfectant at Colchester, and also suggest that those of us who practise surgery should try this method, and record their experience in our Journal? Up to the date of my leaving that hospital about thirty major operations had been performed and union by first intention had invariably resulted. The only preparation which the cases received was a shave on the previous evening and the protection of a piece of dry lint afterwards.

The 10 per cent. spirituous solution of iodine (practically the liniment) is freely painted over the operation area before the administration of the anæsthetic and again before the incision, and the sutures are also painted.

The amount of labour and material saved is enormous. One of the last operations I performed was for dislocation of semilunar cartilage, and no other preparation was made.

If it be found uniformly satisfactory, it would seem worth while to place some of the iodine solution in the field equipment.

I am, &c.,

F. J. W. PORTER,

Sierra Leone. *Major, R.A.M.C.*

THE TREATMENT OF ACUTE GONORRHŒA BY A MODIFICATION OF BIER'S METHOD.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The treatment of acute gonorrhœa by means of Professor Bier's specially adapted exhaust glass is well known, and its efficiency established, but the apparatus is fragile and expensive, and not easily to be obtained in a foreign station or in the depths of the country.

The following modification, which was suggested to me by Mr. Peter Daniels, F.R.C.S., and which I have recently tried with success in my own practice, may therefore be of interest to your readers on account of the ease with which it may be carried out, its simplicity of application, and its cheapness.

It is only applicable to an *anterior* urethritis and must be discontinued at the least suspicion of the infection travelling back into the posterior urethra.

All that is necessary in the way of apparatus is a small length of india-rubber tubing—drainage tubing answers excellently—about the size commonly used for infants' feeding bottles, and a piece of tape. The rubber is tied round the penis and scrotum just in front of the pubes in a single knot, over a piece of tape laid lengthways along the penis. When the correct amount of constriction is produced, the tape is tied round the knot, thus fixing the rubber in position. The constriction should be just sufficient to cause an appreciable venous congestion. The patient's feelings may be taken as a very fair guide. He will experience a distinct feeling of relief and absence of pain when the rubber is correctly applied, and will find no interference with, or pain in the act of, micturition. The tube is applied when the patient gets up in the morning, and taken off when he goes to bed at night. In my opinion the treatment is more successful when the patient is out of bed—not necessarily walking about, but not lying down. There is then free exit for the discharge, and not so much likelihood of the posterior urethra becoming affected. A gonorrhœa bag is not used, a large pad of gauze lying quite loosely in a pair of bathing-drawers, being the best method of catching the discharge, all danger of woollen flocculi becoming attached to the meatus and bottling up the discharge thus being avoided. Saline purgatives and urotropine are the only drugs prescribed; all gastric disturbance by sandal-wood, cubebs, &c., is thus eliminated. The thick purulent discharge will be found to become at first thinner, then muco-purulent, and finally serum alone will well up to bathe the affected mucous membrane. The quick relief to the scalding on micturition is very striking, and the course of the disease is very appreciably shortened, and, moreover, we have in this method one that can be applied when access to drugs is not possible.

I am, &c.,

E. Urquhart Bartholomew,

Captain, R.A.M.C. (*S.R.*).

Green Street, London, W.C.

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Journal

of the

Royal Army Medical Corps.

Original Communications.

THE HOUSE-FLY AS A DISEASE CARRIER.

By CAPTAIN R. B. AINSWORTH.
Royal Army Medical Corps.

I readily admit that the observations recorded and the arguments advanced in this paper are open to the objection that they afford but scanty data upon which to base so important a conclusion that the house-fly is frequently the intermediary and probably by far the most common intermediary, in the propagation of that *bête noire* of Indian sanitarians, enteric fever. Nevertheless, scanty though these data undoubtedly are, rough though the methods employed may be, and brief the period over which the observations extend, there is an isochronism shown in the appended charts between the advent of the house-fly in Poona and the seasonal prevalence of enteric fever, which is highly significant and at least suggests that a *primâ facie* case has been established for further investigation. Ten years ago the theory that enteric fever was a water-borne disease was accepted by everyone, the policy of "the kettle and the cauldron" was a sanitary axiom, and many outbreaks were quoted, in America, Maidstone, and elsewhere, in support of the theory; yet in spite of the strong evidence then produced, in spite of an epidemiological relation apparently incontestable, the opinion has gained ground, year by year, that water is not a frequent carrier, and some even go so far as to say that it is never the carrier.

If water, then, is not the carrier, what is? Manifestly, it can only be one of three things, viz., an infected man or animal;

air-borne through contaminated dust; insect-borne, either by inoculation into the circulation by bites, or by direct deposit on foodstuffs.

I am not concerned, at present, with the two former, and will content myself by saying that there is so far no reliable evidence that domestic animals have anything to do with the propagation of enteric fever, except indirectly, *e.g.*, horse dung as a breeding medium for flies; neither is there any evidence forthcoming that the bites or stings of insects are a factor, though it has been suggested more than once that the bed-bug may possibly be the culprit.[1]

It appears to be clearly established that the human "bacillus carrier" is indubitably the infective focus, but how so is by no means clear. Is it by implanting the bacillus on foodstuffs with his hands soiled with his own excreta? Does he excrete the bacilli through his sweat-glands? Does he perchance cough them up? We do not know. All that we do know up to date is, that a cook, or a dairymaid, who is a bacillus carrier is a danger. And so also with the air-borne theory. Is the bacillus whirled broadcast in infected dust? Again the answer is—we do not know. It is possible, but not probable, and it is worthy of note, that in so far as Poona is concerned the seasonal prevalence of enteric fever is just at the time when dust is least in evidence, *i.e.*, in the middle of the monsoon.

Having thus, so to speak, cleared the ground, I proceed to discuss, as briefly as may be, the possibilities of the fly as a disease carrier and with special reference to the propagation of enteric fever. And, primarily, I would remark that there are a great many more cases of enteric fever amongst the natives than is usually conceded—for instance, out of ninety-two cases of enteric fever collected by me in Poona during the first ten months of 1908, no less than forty were genuine attacks in natives, from whose blood in many instances I isolated pure cultures of *Bacillus typhosus*. Now when the habits of the natives of India are considered, the danger of these cases to the general community cannot be overestimated.

Notwithstanding the fact that much has been written of late regarding the life-history and habits of the common house-fly and

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[1] I am not unmindful of the evidence brought forward in favour of animal etiology by Major Statham in the October Journal, but to my thinking any such theory is hopelessly barred in that it fails to fit in with the proven fact of seasonable prevalence.

many suggestions made relative to its possibilities as a disease carrier, it is to be feared that the general tone of the medical profession with regard to the question is apathetic, if not actually antagonistic. The latter is distinctly in evidence in a rider to the recent reports of the Simla Enteric Fever Committee added by some members thereof, though why they should dissent so emphatically in face of rapidly accumulating proof is hard to understand. Attention has repeatedly been called to the prevalence of flies concurrently with epidemic outbreaks of enteric, and notably by Aldridge (Annual Sanitary Report, Eastern Command, 1904). Similarly, Dr. Snell, M.O.H., Coventry, in 1906, showed that 70 per cent. of the cases of infantile diarrhœa occurred in the north-east part of his district, close to a large collection of refuse where flies swarmed.

Reference to the annexed Table I. and Charts Nos. 1 to 16, which give the admissions for enteric fever for the last fifteen years, month by month, to the station hospitals, Poona and Kirkee, shows very remarkably the regularity of the seasonal prevalence of enteric in these two stations, which, for the purpose of this paper, are considered as one, they being close to each other, in constant daily communication and under exactly similar conditions.

We find then, year by year, that in Poona and Kirkee enteric fever begins in July, reaches its maximum in August, maintains a high level in September, dies down in October, and nearly disappears in November and December. The admissions for the two months, August and September, are considerably higher than those for all the other ten months put together, and for the four months, July, August, September and October, rather more than two and a half times greater than the sum of the other eight months. This is a very striking fact, and points unmistakably to a regularly recurrent cause. Now these four months are the monsoon months, and at first it would seem to afford proof positive that the germs are water-borne; but, apart from the fact that there is a pipe supply from a distant catchment area, not very liable to contamination, and that analyses, both chemical and bacteriological, exonerate the water, it is practically certain that if water were the agent the first outburst would follow the break of the monsoon in the average incubation period, say fourteen days, and the maximum intensity would be reached within the month, as the accumulated filth of the antecedent dry days would be washed down by the first floods. But this is not so, as reference to the annexed charts will show; on the contrary, the

monsoon breaks invariably in the middle of June, and enteric does not become epidemic until August. But heat and moisture, combined with suitable breeding media, will of a certainty produce flies. Unfortunately, I can only speak of this one season, which local residents did not consider to be a very bad year for flies, and yet in July, 1908, the flies were simply appalling, and one medical officer, who is most particular in regard to the sanitation of his bungalow and compound, told me that in two days with six large glass traps he filled a stable bucket with dead flies caught in his own kitchen and back verandah. This will give some idea of their prevalence. Now Poona is a great racing centre, and the racing goes on during the monsoon months. Scores of horses are brought into the station just before the monsoon and stabled anywhere and everywhere. I am credibly informed that over 500 racehorses were in training during the 1908 season, and little or no supervision was, or could be, exercised over the disposal of their litter. Moreover the race authorities, breaking a promise given, covered the course with a fairly lavish top dressing of horse manure. I have hatched out many hundreds of flies from very small quantities of stable litter. Aldridge hatched out over 4,000 from one-sixth of a cubic foot of night soil, and Smith produced them with ease from the soil beneath all sorts of excrement. A very curious circumstance was told me a few months ago by a well-known Indian cavalry officer. He was proceeding with his regiment to China, the stable management was of the best and cleanliness was strictly maintained, yet on the high seas, many miles from land, the ship, all of a sudden, was swarming with flies. I only relate the incident to show how intimately associated the fly and the horse are. Now study the charts numbered 18 and 19; the former shows the triple relationship of rainfall, flies, and enteric fever cases admitted to the Station Hospital, Poona; the latter embraces all the cases of enteric fever which occurred in Poona and Kirkee, and includes, as far as possible, cases known to have occurred among the native population.

Granted that I only had the opportunity of carrying on my observations for one season, yet the coincidence is so striking that, as I have already said, there appear to be ample grounds for further enquiry. Add to this tabulated statement—the result of careful experiment—the general observations made by many medical officers that fly prevalence means probably an outbreak of enteric in the near future, and I think that many will arrive

at the conclusion that the fly is the intermediary between the "bacillus carrier" on the one hand and the susceptible individual upon the other.

A word or two as to how the fly prevalence was estimated: A half sheet of tanglefoot was placed in three different kitchens and changed every twenty-four hours; a count was thereafter made and a daily average struck—a rough and ready method, no doubt, but sufficiently accurate for practical purposes, especially when I add that, at the height of the fly plague, over 700 were caught on a half sheet of paper. Incidentally also, two facts may be quoted, first, that the kitchens used were supposed to be fly-proof, being elaborately protected with gauze; and second, that the daily average of flies caught in the kitchen of the Station Hospital, Poona, during the period the observations were carried out (May to October) was thirty, whilst in the worst of the three experimental kitchens it was just 200.

Look now for a moment at charts Nos. 17 and 20, admitting, unconditionally, that the cases are far too few to afford reliable data upon which to base any sound deductions, still bearing in mind the shorter incubation period of infantile diarrhœa, it may at least be said that, so far as they go, they support Dr. Snell's conclusions above quoted, and go to prove that this exceedingly prevalent and fatal disease is probably fly-borne. And if we concede the point that the fly may be the culprit, or, short of that, the accomplice, in the spread of enteric fever and infantile diarrhœa, where are we going to draw the line of demarcation? Is there any connection between the fly and the well-known fact that residence near a small-pox hospital is dangerous? May diphtheria not be communicable through its intermediation? Are we quite sure that we may not have to revise, anyhow in part, our accepted theory that cholera is entirely water-borne?

Lastly there is the argument from analogy—a weak one, I allow; we do not know why malaria, yellow fever, or plague exist, but we do know that the anopheles, the stegomyia and the *Pulex cheopis* are guarantors that they shall not die out for want of adequate support. Nature has a reason for everything, and we may rest assured that the *rôle* of the fly is not merely that of an irritating nuisance.

What of the remedy? One thing is certain that wire gauze protection to kitchens, alone, is sheer waste of money—money which might be spent to much greater advantage in other directions. Even if wire gauze did keep flies out of kitchens—which it

does not and never will—it would be useless; for it is self-evident that there is much more danger of fly contamination without than within, let alone that thorough cooking will destroy any germ, and that even after cooking there is less likelihood of infection in the kitchen than in the dining-room by reason of the food being hot. The problem is a difficult one—I might, with justice, say a stupendous one; and were it not for the marked success attained by General Leonard Wood and Colonel Gorgas in Cuba and Panama, of which an interesting account is given in the September Journal by Lieutenant-Colonel Macpherson, we might almost be tempted to abandon it in despair.

TABLE I.—Admissions of Cases of Enteric Fever to Station Hospitals, Poona and Kirkee, by Months from January 1st, 1894, to the end of October, 1908.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1894	1	—	3	1	2	4	11	3	13	4	3	1
1895	1	4	12	17	3	1	5	12	7	3	—	1
1896	1	—	8	6	10	4	8	20	7	6	1	1
1897	1	2	5	2	3	—	6	11	16	2	1	—
1898	1	1	3	5	2	1	6	19	15	1	2	1
1899	7	4	3	3	5	7	4	6	3	4	3	—
1900	2	1	2	—	1	2	4	9	25	11	2	—
1901	2	3	2	2	2	3	3	11	6	—	—	1
1902	3	2	2	6	4	3	14	23	20	11	2	—
1903	—	1	3	2	1	1	6	9	37	14	2	3
1904	—	2	1	4	3	3	5	52	18	3	1	—
1905	2	2	—	2	2	2	3	42	36	17	1	1
1906	—	2	—	1	—	—	4	29	24	4	1	1
1907	4	1	2	2	2	1	4	6	5	2	4	3
1908	—	—	2	—	2	2	4	20	5	1	—	—
Total	25	25	48	53	42	34	87	272	237	83	23	13

Clearly, just as with the mosquito, we must attack the fly in the larval stage, and to do that successfully we must know more of its life-history than we do at present. We must, for example, know why it is that in one year flies abound and in another why they are comparatively scarce. Armed with this and similar knowledge we may then hope to approach the problem with a reasonable prospect of a successful solution.

It seems to me that enteric prevention naturally groups itself under five headings, viz :—

(1) Isolation of the human carrier, failing

(2) Elimination of the bacillus by means of some drug as yet undiscovered.

(3) Rendering excreta innocuous, by disinfection, water-carriage and similar sanitary measures.

(4) The establishment of immunity.

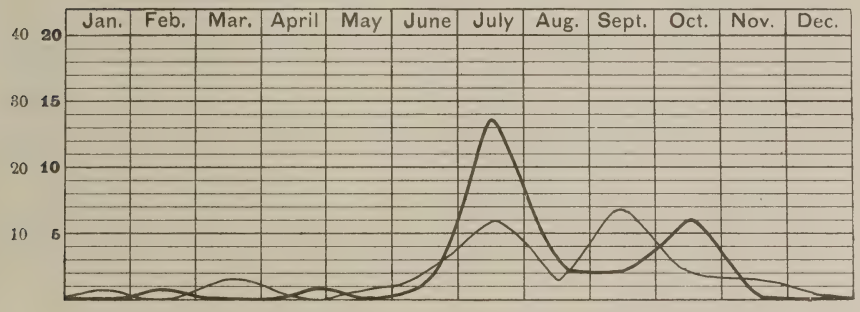
(5) The destruction of the go-between, to wit, the fly.

I cannot conclude these remarks without reference to the great help I have received from Colonel Forman. He has always been a staunch advocate of the *rôle* of the house-fly in spreading disease, and whilst Principal Medical Officer of the 5th Division his sympathy with these opinions greatly simplified my work, in addition to which he very kindly revised the letterpress for this paper.

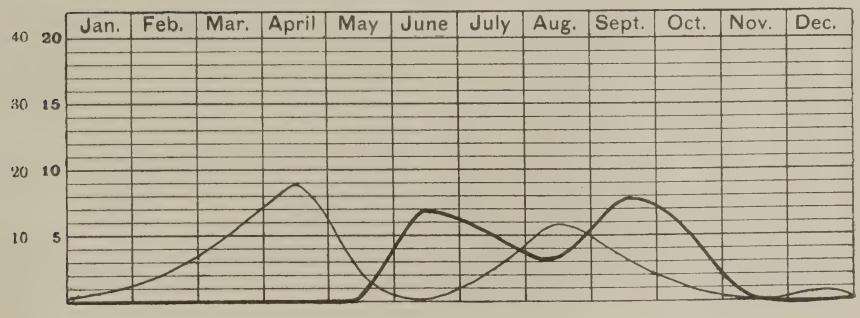
To show Seasonal Prevalence of Enteric Fever. Admissions of Enteric Fever shown by a Thin Line, Rainfall by a Thick Line.

Showing the Admissions of Cases of Enteric Fever to the Station Hospitals, Poona and Kirkee, by Months, from January 1st, 1894, to end of October, 1898, and the Rainfall in Poona for the same Periods.

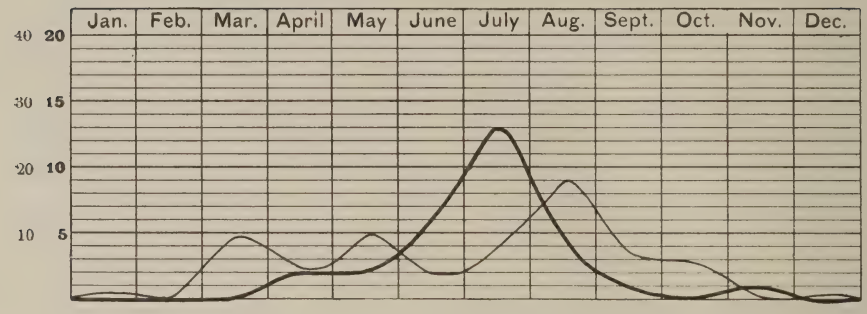
1894. Chart 1.



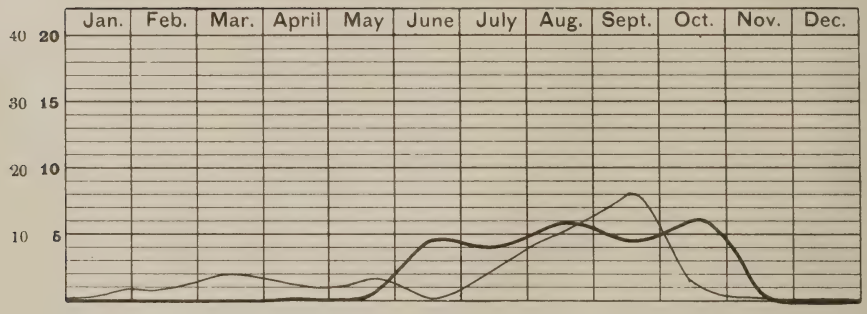
1895. Chart 2.



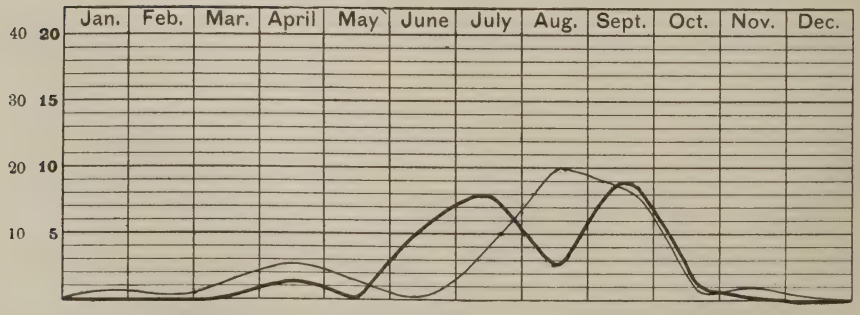
1896. Chart 3.



1897. Chart 4.

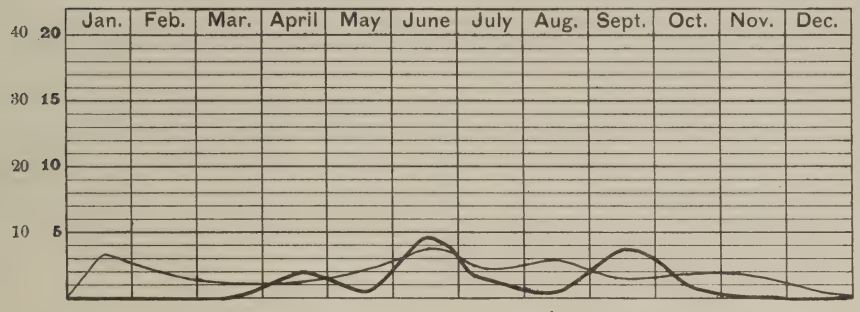


1898. Chart 5.

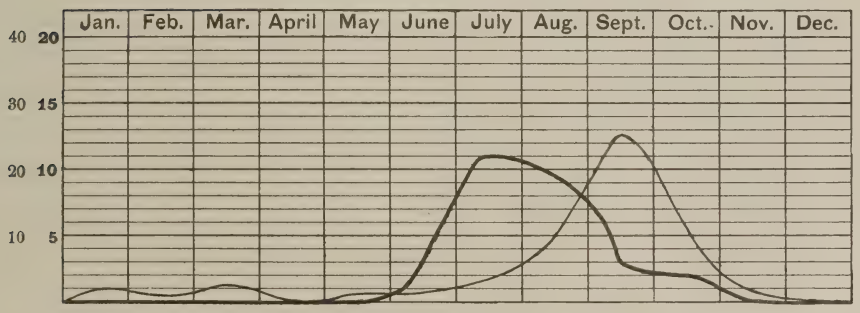


Showing Admissions for Enteric Fever by Months by Thin Line, and Monthly Rainfall by Thick Line, to show Seasonal Prevalence of Enteric Fever.

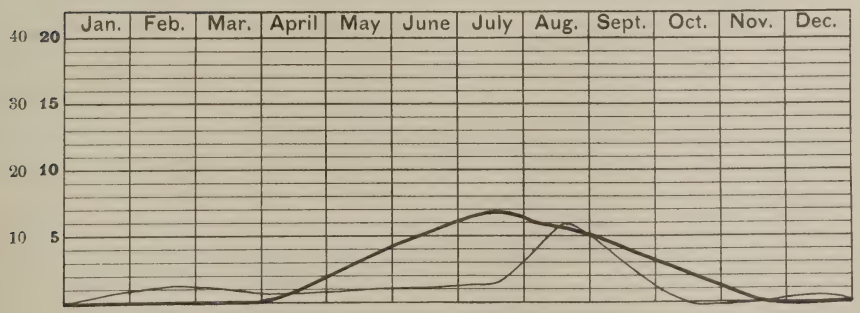
1899. Chart 6.



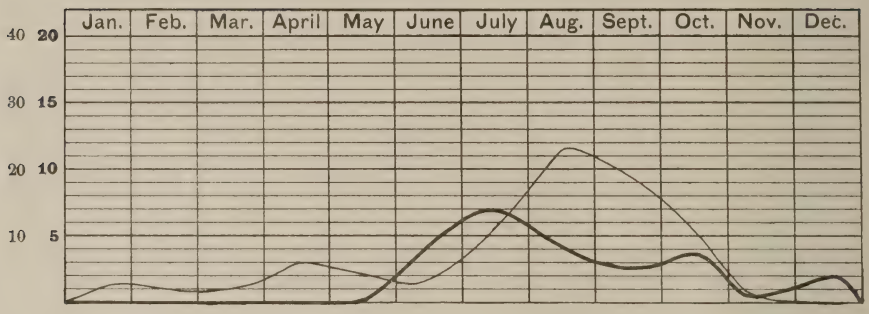
1900. Chart 7.



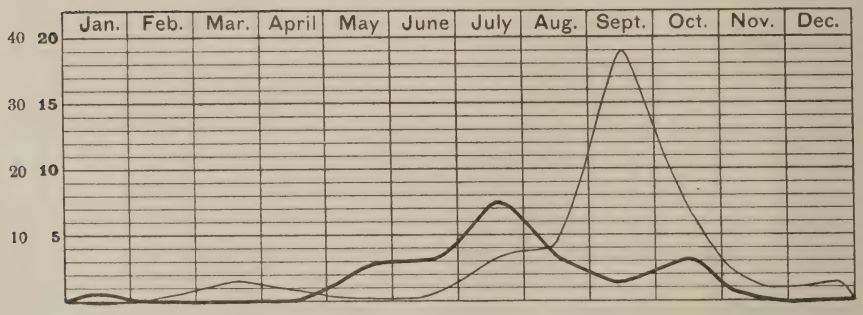
1901. Chart 8.



1902. Chart 9.

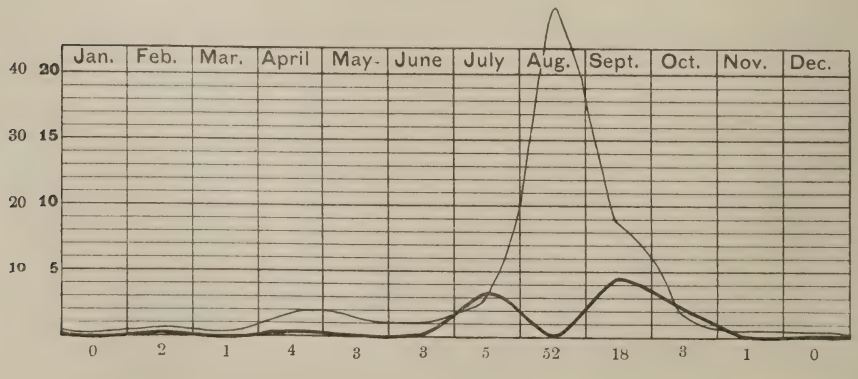


1903. Chart 10.

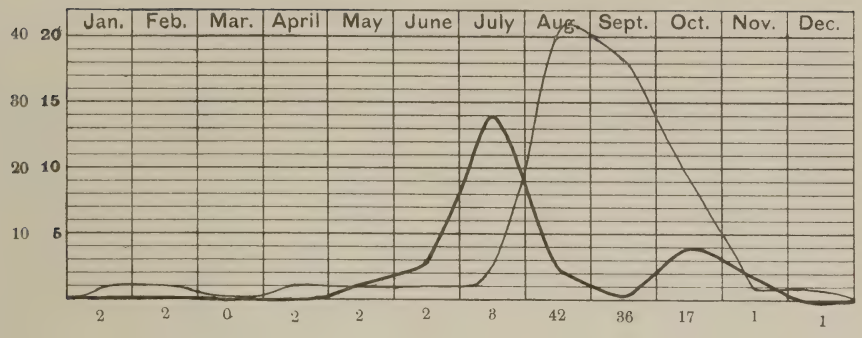


To Show Seasonal Prevalence of Enteric Fever.
Showing Admissions of Enteric Fever by Months by Thin Line and Monthly Rainfall by Thick Line.

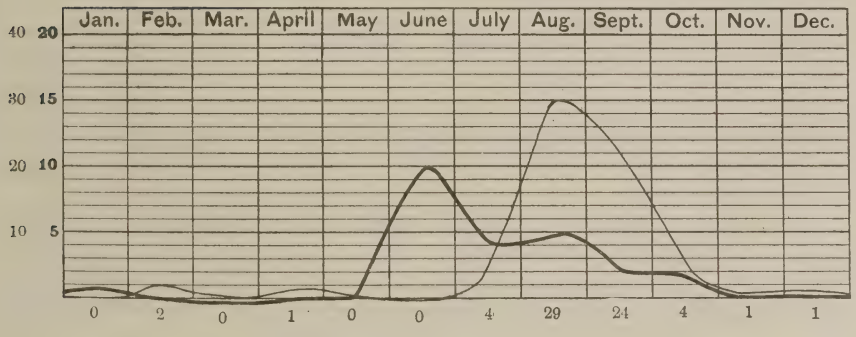
1904. Chart 11.



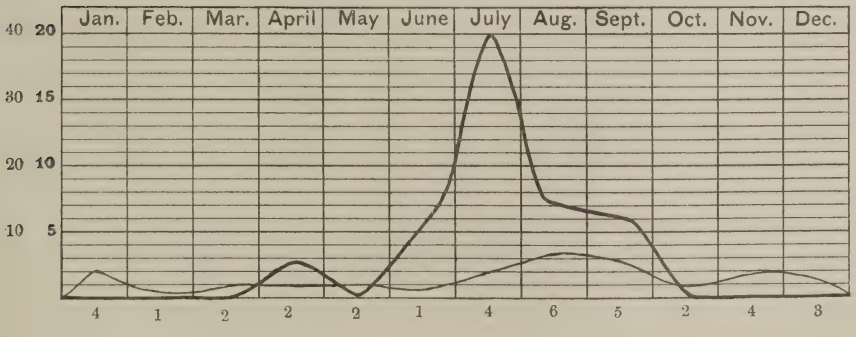
1905. Chart 12.



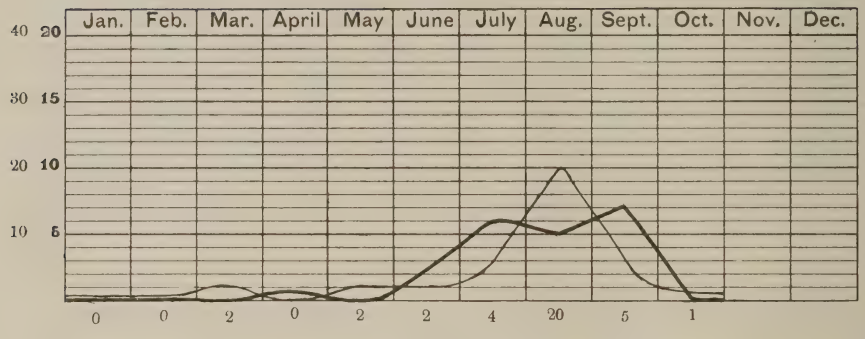
1906. Chart 13.



1907. Chart 14.

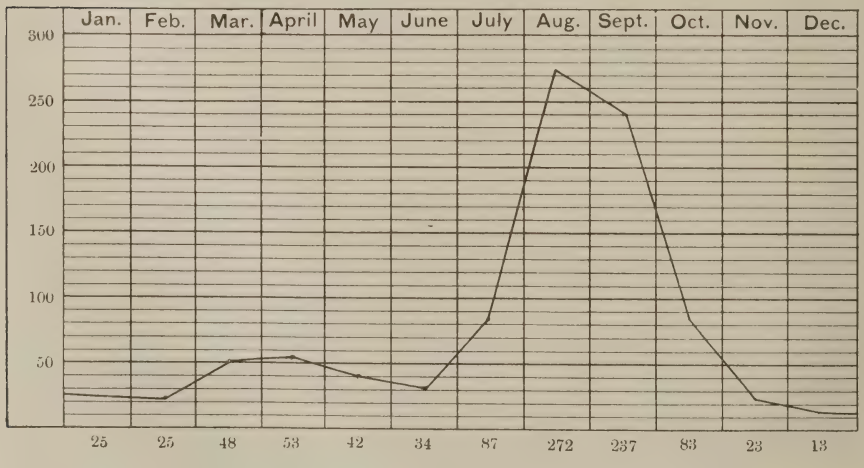


1908. Chart 15.



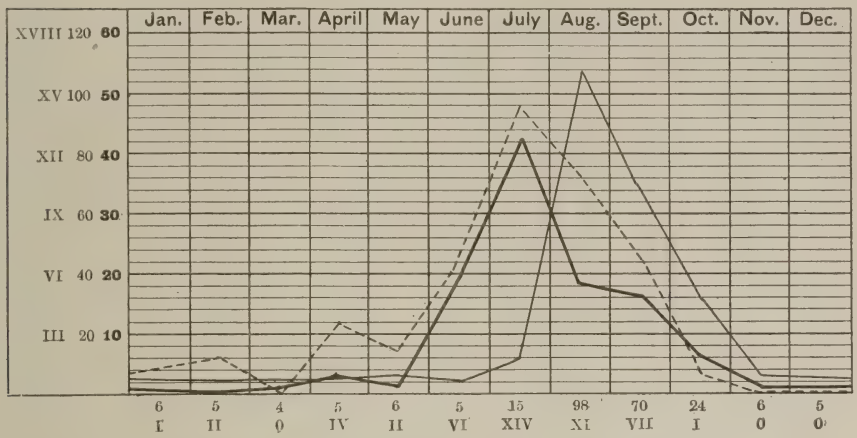
Showing the Total Number of Admissions of Enteric Fever to the Station Hospitals, Poona and Kirkee, from January 1st, 1894, to the end of October, 1908.

Chart 16.



SHOWING THE TOTAL NUMBER OF ADMISSIONS TO THE STATION FAMILY HOSPITALS, POONA AND KIRKEE, OF ALL CASES OF INFANTILE DIARRHŒA; ALL CASES OF ENTERIC FEVER ADMITTED TO THE STATION HOSPITALS, POONA AND KIRKEE, AND THE TOTAL RAINFALL, FROM JANUARY 1ST, 1905, TO THE END OF OCTOBER, 1908.

CHART 17.



INFANTILE DIARRHŒA ADMISSIONS SHOWN BY BROKEN LINE, RAINFALL BY THICK LINE, ENTERIC ADMISSIONS SHOWN BY THIN LINE.

I WAS ONLY ABLE TO OBTAIN THE RECORDS FOR THE LAST FOUR YEARS AS REGARDS THE ADMISSIONS OF INFANTILE DIARRHŒA.

CHART SHOWING CASES OF ENTERIC FEVER TREATED AT STATION HOSPITAL, POONA, FROM JANUARY 1ST TO END OF OCTOBER, 1908, BY BROKEN LINE. DAILY RECORD OF FLIES CAUGHT FROM MAY 23RD TO END OF OCTOBER SHOWN BY THIN LINE, AND DAILY RAINFALL BY THICK LINE.

CHART 18.

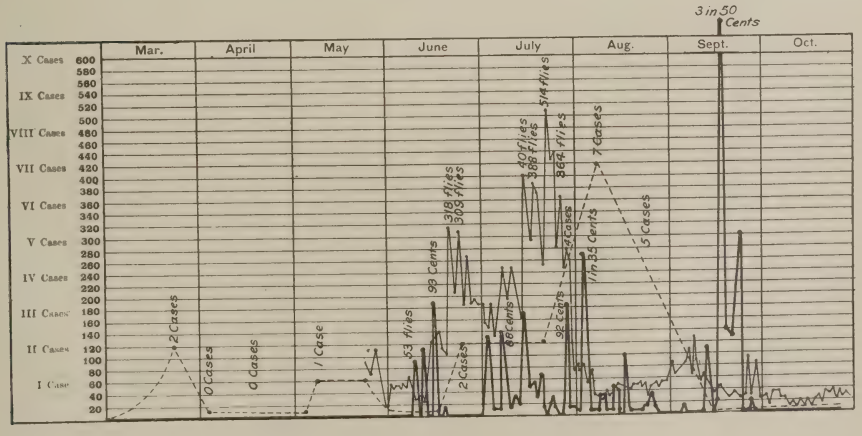


Chart showing Cases of Enteric Fever under Treatment in Poona and Kirkee from May 23 to the end on October. Admissions are shown Fortnightly by Broken Line. Daily Record of Flies for same Period shown by Thin Line. Only Nine Cases of Enteric Fever were under Treatment for First Four and a Half Months of the Year, viz., January 1st to May 15th, 1908.

Chart 19.

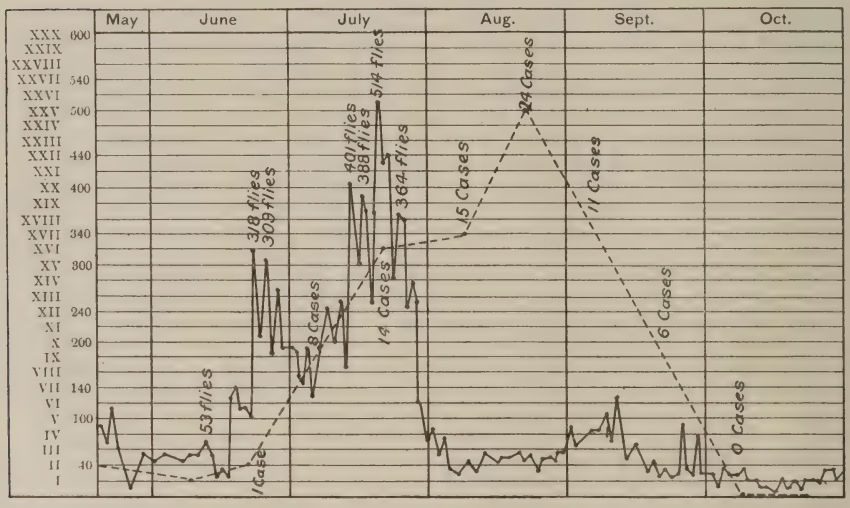
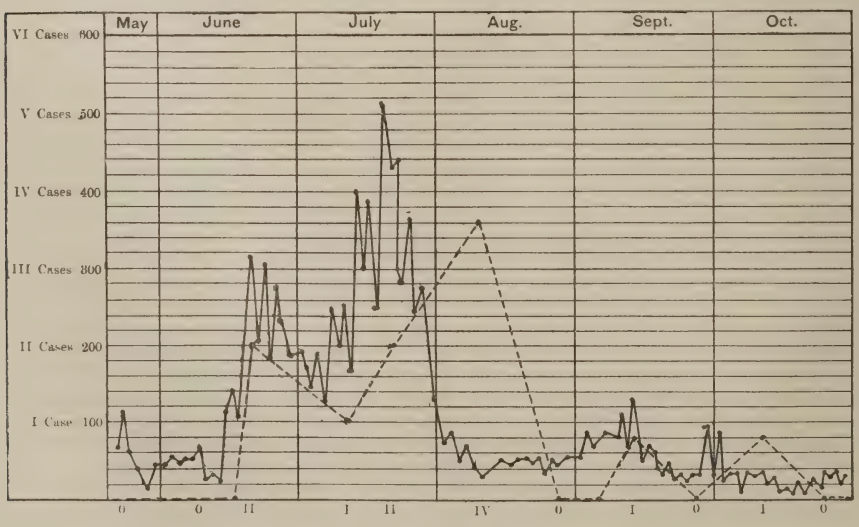


Chart showing Connection between Prevalence of Flies and Infantile Diarrhœa. Number of Flies caught shown by Thin Line, Number of Cases of Infantile Diarrhœa shown by Broken Line. Period in question from May 23rd to end of October, 1908.

Chart 20.



MOTOR TRACTION BEHIND THE FIGHTING LINE.

By Lieutenant-Colonel F. S. HEUSTON, C.M.G.
Royal Army Medical Corps.

Last September, during the inspection of the 5th Division in Ireland by the Inspector-General of the Forces, a very interesting and instructive paper dealing with the Divisional Organisation for supplying our Field Army with ammunition and food, and for the removal of the sick and wounded, was read by Brigadier-General Murray, attention being directed to the co-operation of the Army Service Corps with the Field Ambulance of the Royal Army Medical Corps, so as to employ the transport, bringing forward supplies, in removing the sick and wounded, thus automatically relieving congestion at the front and clearing the lines of communication at the critical time of a general engagement.

"War Establishments, 1908," and "Field Service Manual (Medical), 1908," giving complete details of the Divisional Field Ambulance Organisation, are now in the hands of the officers of the Royal Army Medical Corps; these have been supplemented by lectures and papers, and practical training provided by staff tours and rides; medical officers are therefore rapidly acquiring a valuable working knowledge of the best manner of using to the greatest advantage the increased efficiency resulting from a co-ordination of the duties of the two corps.

This represents a great advance, but would not the use of motor traction still further help us behind the fighting line? Would it not minimise our difficulties, rapidly bring up supplies and ammunition, keep the clearing hospital and field ambulance in touch, and, last but not least, prove an immense humanitarian advance by saving time, danger and suffering in removing the wounded from the fighting zone?

In European warfare during an engagement ambulance wagons cannot advance within three miles of the front, as all roads must be kept clear for tactical movements of the artillery and infantry, consequently in this zone hand carriage of the wounded must be resorted to. The slightly wounded availing themselves of whatever cover they can find from the fire of the enemy incur grave danger of further injury or capture; this could be avoided by the employment of rapid, light cars (10 to 20 h.p.) sent forward as requisitioned from the front. For this service there is available an

unlimited supply of touring cars, the bodies of which could readily be exchanged for wagonette-shaped tonneaux with telescopic seats, making them adaptable for either "sitting up" or "lying down" cases ; a supply of such tonneaux should be kept in readiness.

The seriously wounded could be removed by hand to the nearest suitable shelter, pending subsequent arrangements being made for their efficient care and nursing until they are fit for removal or have been surrendered to an advancing enemy ; this method would remove all danger of the outbreak of epidemic septic diseases, increase the chance of recovery, and save sufferers from the agony and risk of immediate and hurried removal.

To efficiently equip our field ambulances I would suggest that on mobilisation each be provided with three light, swift 10-20 h.p. cars, and three slower 15-35 h.p. cars, with greater accommodation for patients, all being fitted with the special tonneaux and under the Geneva Cross protection. The small motor cars can be used on the line of march to remove from the units of the Field Ambulances those who fall out. During an engagement they can be placed under the orders of the Officer Commanding Bearer Division, Field Ambulance. The large motor cars during the advance would be employed in removing the daily sick and wounded towards the base and replenishing the medical stores and equipment of the field ambulances. During an engagement they can be used in assisting the light cars between the dressing stations and the tent division of the field ambulance, or in removing the wounded from the field ambulance to the clearing hospital.

The clearing hospitals should be able to requisition light cars to enable them to take over and to provide for the proper care of the scattered seriously wounded. If the clearing hospitals find it necessary to advance from the rail-head they should be provided with heavy motor cars to enable them to maintain the evacuation of the sick and wounded to the base.

Adoption of mechanical transport on a large scale would completely revolutionise the field duties of the Army Service Corps, which would be relieved of the provision and carriage of food from the supply base for the thousands of animals which form the second line of transport, five miles of slow animal transport would be replaced by about 500 yards of rapid mechanical transport, road surfaces would not break down so rapidily, and the relief of traffic congestion would show the same beneficial results as has been experienced in London by an increased rapidity of the circulation.

On the line of march baggage would on receipt of orders from

the front move to the new camping grounds, thus adding to the safety of the baggage and keeping the roads more open for the movements of the troops.

During an engagement the motors of the supply columns and parks which are at the disposal of the Divisional General Officer in Command can be used for increasing the mobility of the troops, providing the power of rapid concentration, forwarding ammunition or supplies, and under extreme pressure assisting the field ambulance in evacuating towards the base.

A complete reconstruction of the Medical Field Service arrangements would be necessary, the requirements of the Expeditionary and Territorial forces each calling for separate organisation; the Territorial army must fight at home in thickly inhabited and enclosed country where adequate arrangements for all probable contingencies could be made by the local authorities. The medical and supply units could be systematically co-ordinated, synchronised and trained under experienced officers possessed of practical administrative ability. The Expeditionary army, being exposed to more varying conditions of climate and country, will require a more complicated organisation, calling for as much foresight and care as that of the Territorial force calls for tact and personality.

MOSQUITOES AND MALARIA IN DEHRA DOON, INDIA.

By Lieutenant-Colonel F. WYVILLE THOMSON.
Indian Medical Service (R.).

A study of the incidence of malarial fever and of the distribution and prevalence of mosquitoes in and around the cantonments of Dehra Doon, and of the failure of mosquito reduction measures there, suggests that the method of combating fever by drainage and oiling collections of water within a quarter of a mile of dwellings is by no means so sure and simple as its advocates contend.

After a close observation of the general conditions bearing on malaria in Dehra Doon, kept up at intervals during the last seven years, I am unable to indicate any practicable method of mosquito reduction which would be likely to meet with success in that station.

Dehra Doon cantonments, from their situation, might be considered to be specially well placed as regards ease in conducting operations against mosquitoes, which might be expected to bring about a decrease of malaria. As a matter of fact, this does not seem to be the case.

The old cantonments at Dehra Doon—to which these remarks refer—consist of two sets of regimental lines, for the two battalions of the 2nd King Edward's Own Goorkha Rifles, with the houses of the officers of the regiment and of the Garhwal Brigade Headquarters Staff, and of their servants. The whole area is under complete sanitary control. It lies at an elevation of 2,300 feet, and consists of a narrow plateau running with a gentle slope southwards from the base of the Himalayas below Mussoorie. This plateau is, roughly, about half a mile across, being bounded on the north-west by the Tons River running in a deep, rocky ravine considerably below the level of the plateau, and on the east by a wide, dry river-bed, which contains water during the rainy season only. On the south-west, a large village traversed by an irrigation canal lies between cantonments and the river, about half a mile from the lines, a dry ravine intervening. To the north, the plateau merges into the dry, wooded foot-hills of the Himalayas ; to the south-east, the wide, dry river-bed above mentioned separates cantonments from the city of Dehra. The surface of the plateau is seamed in various directions by dry ravines, which also carry water in the rains only.

The lines of the two battalions lie about three-quarters of a mile apart, those of the 2nd Battalion being to the north, and about 200 feet higher than those of the 1st Battalion. They are quite cut off from the surrounding country by the Tons River and the dry water-course.

The surface of the ground in cantonments is open grass with a few large trees. The ravines, however, are full of low brushwood and undergrowth. The surrounding country consists of cultivated land and jungle, with numerous villages, which are supplied with irrigation canals from the Tons. The soil is sandy and deep, lying on porous, stony gravel. Water never lies on it, however heavy the rain, the drainage being so perfect, owing to the configuration of the surface; and there are no wells.

Drinking water is obtained through a pipe supply from springs in the rocks. In the lines of the 1st battalion there are narrow irrigation canals running in masonry channels in which the flow of water is too strong and rapid to permit of the lodging of any eggs or larvæ. These channels run right through the lines, being the remains of the old drinking water supply, and no water lodges in them anywhere. In the lines of the 2nd battalion there are no water channels.

In the villages in the neighbourhood, and in the town of Dehra, there are, of course, abundant mosquito breeding places, but none of any importance within a quarter of a mile of the barracks.

The rainy season lasts for about two and a half months, the rainfall being fairly heavy and constant, but owing to the slope of the whole country and the porous soil, water never lodges for more than a few hours within cantonment limits. Within half a mile of cantonments there are rice-fields, which contain a few inches of water for months, and are therefore ideal breeding places.

Mosquito reduction operations have been carefully carried on for several years, and all collections of water and depressions in the ground which might give a chance of a breeding place have been dealt with in cantonments. Larger operations in the neighbourhood, whatever their value might be, are, at present, out of the question.

The above description of general conditions is necessary for the elucidation of my argument. It is that mosquitoes travel in great numbers for a distance of over a quarter of a mile, and that adult insects having effected a lodgment in a suitable place survive the winter in multitudes.

There is practically no opportunity for Anopheline mosquitoes to breed in cantonments. The climate is cold enough in winter to stop all pupation and hatching out of adult insects, although eggs and larvæ of both Anophelines and Culicines are never absent from the pools on the Tons River or from the pools even higher up in the Himalayas and Siwaliks. I have found Anopheline larvæ very numerous in January in the streams 3,000 feet up in the Siwaliks,

when there was thin ice on the pools every morning. The species I was unable to identify at the time. These larvæ were apparently hibernating in an arrested stage of development; as when they were kept under observation for a week in a vessel out of doors no pupæ appeared.

I may mention here incidentally that I have observed large numbers of larvæ of *Myzomyia culicifacies* and other species in the moat of the Fort at Delhi, and in the backwaters of the river just outside the Fort, and enormous numbers of *M. rossii* and *M. culicifacies* in the shallow tanks in the gardens of the temples and tombs round Delhi in the months of January and February. This shows that reduction operations should not be suspended during the cold weather when the winged insects are not in evidence, as there is always a large supply of larvæ waiting for the coming of spring and ready to hatch out.

In Dehra Doon cantonments the troops live in barracks of sun-dried brick with thatched roofs, the underside of the thatch communicating directly with the rooms below. Mosquitoes are never absent from these barracks. They increase enormously with the advent of the warm weather towards the end of March, till by the end of April the barracks hum at sunset like beehives, and the men are driven to sleep out of doors. The commonest mosquito is *Culex fatigans*, but there are also numerous Anophelines, such as *M. culicifacies* and *M. rossii*. Since egg-laying is suspended during the winter, and as larvæ cannot have lodged near the barracks in any number, it would seem as if these early comers must be chiefly insects which have hibernated in the thatch of the barracks. They decrease in number in the lines with the advent of the hot weather in May and June, and remain fewer until the commencement of the rains in the early part of July. Then there is a sudden increase, owing principally to the appearance of enormous numbers of Stegomyiæ. These, by their habit of biting during the daytime, add greatly to the discomfort of the men. I was struck by the prodigious number of these Stegomyiæ in the lines, and traced their source, which I may here mention.

About the barracks are a lot of fine old mango trees. In these, where branches have broken off by the wind, hollows are left, which remain filled with rain-water, generally quite black from the decaying wood. These hollows the Stegomyiæ use as their special breeding-places, and I have seen the water almost solid with larvæ, which, however, quite escape casual notice unless the water is lifted out in a cup or glass. In the daytime the myriads of newly hatched

insects of many species, such as *Stegomyia sugens*, *S. gubernatoris*, *S. scutellaris*, *S. fasciata*, *S. nivea*, &c., resting on the inside of the hollows, and lining the dark wood, their white markings showing up in strong contrast, is a striking sight. Reduction measures here were easy, and when the hollows had been filled up or obliterated, a marked lessening of the Stegomyia nuisance was effected.

To return to the more important Anophelines, it would seem that large numbers hibernate in the thatch of the barracks. Owing to the absence of doors or windows, to the free air current through the thatch, and to an air-space which exists between the roof and the top of the wall, all attempts at fumigation were failures. Probably the substitution of tiles for thatch would effect a great improvement, by affording a less suitable resting place. The new lines for the 9th Goorkhas in Dehra Doon are tiled, and although conditions are not at present comparable between the regiments for several reasons, a few years may show that tiles are of advantage both for health and comfort. The great objection the mosquito would have to tiles is that in the daytime when the sun is shining they get much too hot for it to rest on with comfort. Tiles are also probably sterilised by the intense heat of summer, and all germs destroyed. This certainly does not happen to the under-side of thatch, which becomes filthy with dust, organic and in-organic.

As we have seen that there is little opportunity for mosquitoes to breed in or very near the lines, the next question to consider is how the supply is kept up. Granted that the great bulk of them make their way to the lines during the period of greatest plentiful-ness—towards the end of the monsoon—and hang about the barracks all winter, the stock must be reduced by death and by the fecund females going off in search of water.

The deep ravine of the Tons River comes within a quarter of a mile of the north-west corner of the lines of the 2nd Battalion, although the water is actually a good deal further off owing to the depth of the ravine. To find their way to the lines, the insects would have to rise from 50 feet to 100 feet, and then fly about a quarter of a mile. The bed of the river is lined with rocky pools of all sizes which are never free from larvæ of many kinds, *M. culicifacies* being present all the year round. The course of the river now runs away from cantonments, but further south there is a smaller ravine, which although dry in summer is turned into rice-fields in the rainy season. These rice fields lie at a distance of about 600 yards west from the lines of the 1st Battalion. Further

south and to the east, there is no good breeding place within half a mile. About half a mile further west there is a large and dirty native village with numerous irrigation canals, which, of course, abound with mosquitoes and breeding places.

It would appear, therefore, from the above description, that the stock of mosquitoes in the lines is replenished either from the Tons or from the rice-fields and villages at a distance of from a quarter to half a mile away. If this be so it follows that mosquito reduction measures, to be effectual, must affect not only the immediate vicinity of dwellings, but also an area extending half a mile at least round the spot to be protected. In a place like Dehra this takes us beyond the range of military sanitary authority, and brings us into contact with the civil rural population, where effective measures are impossible. I regret that I am unable to quote figures to show the amount of malaria in the 2nd Goorkhas, but there is always a good deal. There is more in the 1st Battalion than in the 2nd, probably because the former lies lower and nearer to the rice-fields, to the above-mentioned village, and to Dehra city. The 2nd Battalion is higher and more open and wind-swept, although nearer the river.

Referring to the factor of wind, the prevailing wind in the hot weather blows from the west, the side on which the village and rice-fields lie. It is quite possible that mosquitoes are blown into the lines that would never fly there of their own accord.

As regards the malaria in the regiment, all cases certainly do not originate in the lines. Men coming from Nepaul on enlistment or on return from furlough are very often affected before arrival. The men are in the habit of strolling about the neighbouring villages in the evening. They also go shooting in the jungles of the Doon, where the villagers are saturated with malaria. But the fact remains that there are plenty of fever-carrying mosquitoes about the barracks ready to inoculate the healthy from the infected.

The commonest type of fever was the benign tertian. Malignant tertian was less frequent, and quartan was rare. A certain number of cases failed, after repeated and careful microscopical examination of the blood, to show any signs of the malarial or other blood parasite, although the clinical features of the cases resembled those of malaria.

A prophylactic issue of quinine to the amount of 10 grains twice a week to every man during the feverish months of late summer and autumn seemed to have little or no effect in reducing the number of cases.

An observation I made, which has nothing to do with Dehra

Doon, but which is of interest in connection with the question of breeding places, is worth recording. At Meerut, in the month of March, a road watchman lived at a grass hut a few miles out of cantonment, by the side of the road, in a particularly barren and dried-up locality. He told me that he could not stay in his hut day or night on account of the mosquitoes. On entering the hut I found the air to be thick with *Culex fatigans*. As there was not a drop of surface water, and nothing but baked earth or dust within a mile all round, I was puzzled as to the source of the insects. On looking round, however, I found that there was a well in a field within fifty yards of the hut. The water in the well must have been about 15 feet from the surface. Notwithstanding this, on looking in I saw that the brickwork sides of the well were literally black with mosquitoes, and on throwing in a stone a cloud of them darkened the air. This one well must have been producing millions even by the month of March, and if the same process is going on all the summer in the wells all over India, this source alone must be responsible for keeping up a very fair supply.

The task of combating malarial fever in India by means of mosquito reduction is a stupendous one. Its difficulty is greatly increased if the area treated round habitations has to be extended as far as my experience at Dehra Doon would seem to show to be necessary.

It was difficult to obtain specimens of the insects in the barracks. At daybreak they vanished into the thatch, but I made use of a device which was moderately satisfactory. A box (the ordinary and useful oil-box of India) was lined inside with black cloth. This box was placed with the lid open on the wall in a corner of a barrack towards evening and left all night. In the morning the lid was quietly shut and a morsel of wool soaked in chloroform was introduced through a hole fitted with a cork. The mosquitoes could then be removed for examination.

The commonest species in the barracks were *M. rossii*, *M. culicifacies*, *N. maculatus*, all the Stegomyiæ, and *C. fatigans*. Stray specimens of many of the other varieties were also found.

In the rock pools of the Tons River, the most frequent were *A. lindesayii*, *M. culicifacies*, *M. nigerrimus*, *N. maculatus*, *C. fatigans*, *C. concolor*, *T. ochraceus*. I noticed that *M. rossii* revelled in pools of stagnant water so green and foul that no other variety could stand it. Towards the end of the rainy season they appeared in prodigious numbers in small, foul pools near villages. It seemed as if they could withstand desiccation, or at least

entombment in dried mud. After a few days of sunny weather these pools would dry up until the surface was baked and cracked. Twenty-four hours after a shower of rain the pools often contained full-grown larvæ which could not have hatched out from eggs in the time, as well as newly hatched larvæ which probably came from eggs which had also been in the dried mud.

The following is a list of mosquitoes inhabiting Dehra Doon and the country in the immediate neighbourhood. They were captured or hatched out from larvæ by me or by Colonel F. W. Wright, I.M.S. (R.). Most of them have been identified by Colonel Giles, I.M.S. (R.), Mr. F. V. Theobald, or Mr. E. E. Austen, who most kindly gave me their assistance. The list does not pretend to be complete but it is fairly representative. *Stegomyia thomsoni* (Theobald) and *Finlaya anopheloides* (Giles) had not previously been described, and there also appeared to be a new *Anopheles* and a new *Culex*.

ANOPHELINÆ.

Anopheles lindesayii.
Myzomyia rossii.
,, *culicifacies.*
,, *christophersi* (*A. listoni*).
Myzorhynchus sinensis (*A. nigerrimus*).
Nyssorhynchus fuliginosus.
,, *maculatus.*
,, *theobaldi.*
,, *maculipalpis.*
Cellia pulcherrima.

CULICINÆ.

Mucidus scatophagoides.
Stegomyia sugens.
,, *scutellaris.*
,, *pseudotæniata.*
,, *gubernatoris.*
,, *nivea.*
,, *fasciata.*
,, *thomsoni.*
Culex tigripes.
,, *viridiventer.*
,, *fatigans.*
,, *gelidus.*
,, *concolor.*
Tæniorhynchus ochraceus.
Finlaya anopheloides.

THE OFFICERS' TRAINING CORPS.

By Lieutenant-Colonel H. E. R. JAMES.
Royal Army Medical Corps (R.).

The general object of this organisation is to provide officers for the Regular Army, for the Special Reserve of Officers, and for the Territorial Force; and its method of working is to give a standardised measure of military training to boys and young men of the educated classes at schools and Universities.

The University contingents form the senior and the school contingents the junior division of the Officers' Training Corps. Training in the junior division is practically confined to that of infantry; in the senior division, cavalry, artillery, engineers, medical service, and veterinary corps are also represented, in addition to infantry. For the purpose of training, training-units are formed, *e.g.*, squadrons of cavalry, batteries of artillery, companies of engineers, and, in the medical branch, sections of a field ambulance. The infantry is formed into companies.

The contingent produced by a school or University may comprise one or more of such units, each of which, to obtain recognition by the Army Council, must number thirty cadets at least.

The Officers' Training Corps is under the immediate control of the War Office in point of finance, and the school or University producing a contingent makes itself responsible for the training of such contingent, the Director of Military Training at the War Office maintaining control over the training.

In the case of a University a military Education Committee must be formed, which comprises as members officers of the Officers' Training Corps contingent of the University.

The *personnel* of the Officers' Training Corps consists of officers of the Territorial Force seconded for duty with the Officers' Training Corps, and cadets who, as indicated above, are students of schools and Universities or Colleges, and others who are permitted to join contingents under the *ægis* of these institutions.

The training units of the Officers' Training Corps are not mobilised in time of general mobilisation, nor are the cadets under military law nor under any obligation to join the Army, Regular or Territorial, by reason of belonging to the Officers' Training Corps.

Cadets serve under a contract drawn up by the several Universities and schools, to whose contingent they belong. The contract is approved by the War Office, and contains clauses giving an understanding to obey orders, and specifying the period of engagement to serve and penalties in default. The officers, in the case of schools, are usually masters, and in the case of Universities members of the University staff and undergraduates. In schools there are also cadet officers, who are not, as in the case of other officers, of the Territorial Force.

Discipline is practically left in the hands of the school and University authorities, and the only penalty for misconduct is summary dismissal by the officer commanding; in case of failure to complete the proper term of service or to become efficient, or to obtain the necessary certificate, fines are inflicted to meet the loss which would be entailed on the corps fund by such default.

No physical examination is imposed by the Regulations upon applicants to join, although it is within the power of the body offering the contingent to require such examination of recruit cadets for its contingent.

The only physical qualification required by Regulations is that the cadet shall be physically able to perform his duties to the satisfaction of his commanding officer, by whom he must be accepted before being allowed to join.

It will appear from this that the scheme is generous in its conception, as it gives training to men who may not be able to qualify physically for the Regular or Territorial services, and does not bind anyone undergoing the training to join these services.

Uniform, of a pattern chosen by the school or University, is supplied by Government, conditionally upon the recipient becoming efficient, and arms and equipment are supplied to the several units. The expenses of cadets in camp, and of their journeys from their headquarters to and from camp, are defrayed by Government at a fixed rate. Members, therefore, do not incur any personal expense by joining.

The training has two phases, and can be condensed into two years. In this case which is only applicable to the senior division, the two phases are concurrent. Two certificates may be obtained: certificate "A" at the end of the first phase, and "B" at the end of the second. "A" can be got in the junior or senior division; "B" in the senior division only, and cannot be obtained except by a holder of "A." A minimum of one year's service is required for "A," and of two years for "B," but, as already stated, the

two may run concurrently. The cadet must have made himself an "efficient" in these years. To obtain the certificate in the first year, attendance at thirty parades of not less than forty-five minutes of actual instruction, and at a camp of eight days' duration, and at the inspection is essential; in the second year fifteen drills and a similar camp and inspection are required.

The subjects of examination for certificates "A" and "B" vary according to the branch to which the cadet belongs; but the "A" obtained in the junior division is by examination in infantry subjects, and is accepted in all branches, with the addition of extra subjects for "B" in corps other than infantry. This "all arms" examination for "A" is written, oral, and practical, and is in the following subjects:—

"Infantry Training," definitions, sections 45 to 58, 76, 89, 89a, 126, 127, 128 to 150, 169 to 171, 201 to 205. "Combined Training," Chapters IV. and VI.; squad and company drill; the tactical handling of a section of at least twenty-five men; care of arms; mechanism of the rifle; elementary musketry exercises.

The medical certificate "A" is obtained by examination in the following subjects:—

First Part.—"Royal Army Medical Corps Training," Part I., chapters II., III., VI.; Part II., chapter IX. *Second Part.*—Squad and company drill. "Royal Army Medical Corps Training," Part I., chapters IV., V., VII., VIII.; Part II., chapter X.

The first part of the examination is written, and the second part, from squad and company drill, is oral and practical.

Certificate "B" in the different branches also varies in its subjects. Here, again, there is an "all arms" certificate, which is devised for infantry, and which is valid for other corps, with the addition of corps special subjects. The written examination for the "all arms" certificate includes field sketching, tactics, military engineering, map reading scales, use of compass, attack and defence of a house, post or position; a simple problem in tactics, engineering, and topography, entailing the employment of all arms; military law and King's Regulations as for promotion from lieutenant to captain (books allowed).

The oral examination includes the general system of organisation of the army; the system of command, organisation, discipline, and administration of a squadron, battery, or company in peace and war; duties in the field, as applicable to each arm; marches, outposts, map reading, reconnaissances (including rough field sketches), attack and defence, including engineering details con-

tained in Part I., "Manual of Military Engineering, 1905," with the exception of chapters XII., XIV., and XVI.; and any duty or work which a captain may fairly be called upon to perform in the field.

The medical certificate "B" requires a knowledge of the following subjects:—

Written examination: War establishments and organisation of field medical units; military law and King's Regulations as for lieutenant to captain. Oral examination: Work of medical units in the field; sanitation and other duties in barracks, camp, and on the line of march; map reading; general system of organisation of the army; the system of command, organisation, discipline and administration of a company in peace time, and a field unit in war.

Semaphore signalling may be taken as an optional subject for certificate "A," and the history of the British army (prescribed period) for "B."

The medical cadet has several courses open to him. He may:—

(1) Take certificate "A" in the junior division in his school corps, and certificate "B" in his University combatant corps, with the addition of medical subjects in both cases (this involves an extra year in the medical unit).

(2) Take both certificates in his University combatant corps.

(3) Take "A" in his school and "B" in his University medical corps.

(4) Take both in his University medical corps.

The optimum training is obtained in case 3, as the cadet is thoroughly grounded in military matters, and can devote the whole of his energies to the medico-military subjects in his University medical unit.

Holders of these certificates have certain advantages, which are shown in table on the following page.

The general scope of the training is that of the medico-military training given to young officers of the Royal Army Medical Corps at Aldershot, and it will be seen that the possession of certificate "B" exempts its holder from the whole or part of the examination for promotion to the rank of captain in the case of a Territorial officer. Training is carried out under the general direction of the director of military training, by the officers of the several units. In addition to financial help and the supply of arms and equipment, Government appoints an adjutant, who is an officer of the regular forces, to the headquarters of a contingent to assist in the training and to co-ordinate work; also N.C.O.'s as instructors, in the pro-

portion of approximately one per unit, to assist in the training. Officers of the various areas of the regular forces are temporarily attached to units to help in the preparation of cadets for certificate "B." Courses of lectures are also provided to help in such preparation.

	Certificate "A" will entitle the holder—	Certificates "A" and "B" will entitle the holder—
(i.) Should he take a commission in the Special Reserve	(i.) To a reduction of the probationary training by 4 months, or 14 days, according as the normal period is 12 months or 3 months	(i.) (*a*) To a reduction of the probationary training by 8 months, or 1 month, according as the normal period is 12 months or 3 months. (*b*) To a gratuity of £35 payable at the same time as his outfit allowance.
(ii.) Should he take a Territorial commission	(ii.) To exemption from the whole or part of the examination for promotion to the rank of lieutenant	(ii.) To exemption from the whole or part of the examination for promotion to the rank of captain.
(iii.) Should he offer himself as a candidate for Woolwich or Sandhurst	(iii.) To receive 200 marks in the competitive examination held by the Civil Service Commissioners for entrance to those establishments.	
(iv.) Should he offer himself as a candidate for a commission in the Royal Army Medical Corps	(iv.) To receive 1 per cent. of the maximum number of marks allotted to the compulsory subjects in the entrance examination	(iv.) To receive 2 per cent. of the maximum number of marks allotted to the compulsory subjects in the entrance examination.

The theoretical work and the ordinary drill parades take place during the winter term, and the field work and camps in the summer. In the case of the medical units, all of whose cadets at the present moment are working for certificates "A" and "B" concurrently, about fifty attendances are required in the first year and thirty-five in the second, in addition to the eight days in camp in each year required to cover the drills and parades necessary for efficiency, and the lectures and demonstrations which they have the opportunity of attending.

The unit which has been chosen as a training unit for the medical branch is a B or C section of a field ambulance, and the following reasons have weighed in its choice:—

(1) It is the only unit which possesses its own means of transport when mobilised, and gives a knowledge of that important branch of work.

(2) It follows the movements of the body of troops of which

Syllabus of Training in Camp.

For the guidance of officers in preparing syllabuses for camps of instruction in the Regular Royal Army Medical Corps and for annual camps of field medical units in the Territorial Force. This syllabus may be adapted to camps of varying duration by repeating or omitting such stages or items as may be suitable. As a rule not more than two days should be occupied by Preliminary Training, which in suitable cases may be omitted or shortened. If the instruction would thereby be rendered more efficient, the stages may be transposed and the various items interchanged or varied.

Every opportunity should be taken of giving instruction in army organisation ; interior economy in peace and war; reports, returns, and indents ; and in sanitation and prevention of disease.

	Preliminary Training		Intermediate Training		
	Stage A	Stage B	Stage C	Stage D	Stage E
Morning, 1 hour ..	Squad and Company drill	Squad and Company drill	Hand seats and improvised carriage of patients	Preparing operating tent and tents for sick. Preparing G.S. wagons and country wagons for carriage of wounded	F.A. formation and movements.
Forenoon, 1 hour..	Stretcher exercises..	Equipping, loading and unloading ambulance wagons	Lecture on Geneva Convention and system of removal of sick and wounded from front to base	Preparing G.S. wagons and country wagons for carriage of wounded and practice in loading and unloading wounded	Collecting wounded (including improvised carriage, formation of dressing station), laying out F.A. encampment and reception of wounded. Preparation of bivouacs and shelters.
Two hours ..	Checking equipment and examining contents	Packing and loading F.A. equipment	First aid and removal of wounded according to injuries and carriage required	Practical instruction in making field kitchens and latrines and in methods of refuse disposal	

SYLLABUS OF TRAINING IN CAMP.—*Continued.*

	PRELIMINARY TRAINING		INTERMEDIATE TRAINING		
	Stage A	Stage B	Stage C	Stage D	Stage E
Afternoon ..	N.C.O.'s and men—Tent pitching and instruction in guard and piquet duties Officers—Lecture on field medical organisation and the *rôles* of medical units	N.C.O.'s and men—Tent pitching and preparing tents for patients Officers—Lectures on duties in camp, on line of march and in the field. Combined training Ch.I., II. and III.	N.C.O.'s and men—Demonstration of water purification and explanation of sanitary methods in the field Officers—Map reading and study of ground, selection of sites for encampments, billets, hospitals, &c.	N.C.O.'s and men—Packing and loading F.A. equipment. Forms and returns in the field Officers—Map reading and study of ground, estimation of distance with reference to the ordinary danger zones for rifles and shell fire. Selection of sites for dressing station	Coupling horses, mounting and dismounting wounded men. Demonstration in stable management, in horse lines.

The Transport Section of the Royal Army Medical Corps Territorial Force will attend such of above as are applicable, and in addition will be instructed in riding, driving, stable management, fitting saddlery and harness and the care of horses.

ADVANCED TRAINING				
Stage F	Stage G	Stage H	Stage I	Stage J
Exercise as a unit in the field, as if with troops holding a defensive position Large numbers of wounded to be collected, treated and classified for disposal Reports and returns to be prepared	Do. ; as if with troops during an attack on defended positions	Do. ; as if with troops during a battle of encounter	Do. ; as if with troops during a retirement	Exercise as a unit in the field with other troops, having regard to the size and nature of the medical unit represented.

it is a part, and is the most actively mobile unit, giving experience in a variety of work and sustaining the interest.

(3) Its work differs widely from the routine work of the medical student, and affords the variety and relief which constitute a recreation (a general or stationary field hospital or an evacuation unit's work is comparatively dull).

(4) It can keep touch with the other units of the University contingent during training in camp, and so maintain social intercourse.

But although this is the training unit the training is not confined to the work of it, or any other single unit, but is of wider scope and covers the duties of medical officers at large.

The annexed programme of work in camp will show the type of field training of the medical units. (See pp. 514 and 515.)

The present strength of the Medical branch is approximately 350 cadets and 13 officers, that of the Officers' Training Corps altogether being between 15,000 and 16,000, inclusive of senior and junior divisions. Practically all the former University volunteer corps, as well as the corps of public schools, have transferred to the Officers' Training Corps. It is also probable that other Universities, besides those which already contribute medical units, will do so when the advantages of the scheme are fully known.

The Universities which possess medical units at the present time are Edinburgh, Cambridge, Oxford, and London.

The organisation is as yet in its infancy, and until another year has passed it will not be possible to appreciate its value in the matter of supplying the material that is hoped from it; but at least it promises well, and even if it should fall short of finding officers for the Special Reserve and the Territorial Force it must make a considerable body of medical men conversant with army routine and methods, and so fit them to serve with armies in the field in an efficient manner.

The Officers' Training Corps is quite distinct from the Territorial Force, and although the Officers' Training Corps and the Territorial Force are administered and financed from different sources, it is intended that, as far as possible, they shall co-operate in the manner most advantageous to both.

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THE TERRITORIAL FORCE.

By Major E. C. FREEMAN.
Royal Army Medical Corps (R.).

The Territorial Force is an organisation important to the welfare of the British Empire, and to the officers of the Royal Army Medical Corps it has also a personal interest, because it offers many new appointments to men on the retired and full pay rosters—and because any medical officer holding an administrative appointment at home is certain to be brought into contact, one way or another, with the Territorial Medical Service.

To officers returning from abroad the whole thing is a novelty, and information on the subject is not very accessible, so a brief *résumé* may perhaps be welcome amongst the more scientific papers in our Corps Journal.

The Territorial Force came into existence on April 1, 1908, and in it Mr. Haldane has welded together into a homogeneous whole the various scattered elements which previously existed for the purpose of National defence, and has adapted them to the conditions of modern warfare.

The men of the Territorial Force are the same who previously served in the Yeomanry and Volunteers; the yeomanry being drawn chiefly from the farmers and the innkeepers, the infantry from the workmen, shop assistants and labourers. To all the question of pay is of great importance, as they cannot leave their work for a week or a fortnight without it. The great success of the Royal Army Medical Corps Territorial is certainly partly due to the extra remuneration its members get in the shape of corps pay. The old type of volunteer who served for the sake of "soldiering," and who cheerfully paid his own expenses, is quite extinct, except perhaps in the Officers' Training Corps, of which more anon. A "separation allowance" is made to married serjeants in camp, but to the rank and file only on active service.

All regimental equipment, drill halls, &c., have become the property of the Territorial Associations; otherwise the yeomanry regiments continue almost unchanged, and the other Territorialists serve under conditions very similar to those of the old volunteer system—the chief practical difference being that attendance at camp for eight days is compulsory, and an attendance of fifteen days is aimed at whenever possible. Drills are put in at other

times besides, as was the case with the Volunteers, and twenty such must be completed before camp.

The military status of the Territorialist has immensely improved. He is no longer an amateur, but is medically examined, attested, and enlisted for four years. When on duty he is always subject to military law, and while training draws the full pay of his rank and arm of the Service.

A certain proportion of the Territorial soldiers are allowed to enlist in the "Special Reserve," for which they receive a bounty of £4 a year and undertake to serve abroad with the Regular Army in an emergency.

The lack of officers was admittedly the weakest point in the volunteer system. To remedy this, Officers' Training Corps have been formed in connection with the Universities and Public Schools, Inns of Court, &c., for the purpose of imparting military knowledge and training to young men while at an impressionable age, thus forming a solid foundation for the pursuit of the further studies required in the making of an efficient officer.

The obligations of the Territorial officer as to training are similar to those of the private. He also draws full pay and allowances during training, whether in camp or at a recognised course of instruction.

A most important part in the Territorial Force is played by the County Territorial Force Associations. These are an entirely new series of public bodies formed of unpaid representatives of all classes of the community in each county. Each Association is responsible for the administration and financing of all Territorial troops raised in the county limits, drawing the necessary funds from the War Office, which gives a fixed grant for each unit that it finds efficient. The County Association thus relieves the commanding officers of the financial responsibilities which were often crushing under the old *régime*, and also—as it has accurate knowledge of local conditions—it can often adjust matters to suit local requirements in a way that no centralised authority is capable of.

The County Associations are also useful in bringing together employers of labour and inducing them to give their employees leave for camp, and in spreading a knowledge of military requirements through the whole population of the country.

While the administration of the Territorial Force is in the hands of the County Associations, the whole of its military training is in the hands of organisations provided by the War Office—and it is in the existence of this organisation that the enormous

superiority of the Territorialist over the Militiaman and the Volunteer lies.

Briefly, then, apart from the Artillery and Engineers told off to garrison certain fixed points, and the Officers' Training Corps, the whole of the Territorial troops are divided into fourteen divisions with fourteen mounted brigades. Each military district in Great Britain furnishes one of these divisions, except London, Lancashire and Yorkshire, which provide two each. The whole force is under a Director-General at the War Office.

Each division is commanded by a Brigadier-General, who is a regular officer and has his headquarter office and staff. The division consists of three infantry brigades, each brigade having four battalions and being commanded by a permanently appointed Brigadier, three Field Artillery Brigades, Howitzer and Heavy Batteries, Field and Telegraph Companies of Engineers, Army Service Corps Company, and three Field Ambulances.

The mounted brigade consists of three Yeomanry regiments, with Horse Artillery, Royal Engineers, Army Service Corps and a Cavalry Field Ambulance. A Yeomanry regiment is also detailed as divisional cavalry.

The training of this force is carried out under the General Officers Commanding in Chief, the General Officers Commanding the territorial divisions and the mounted brigades. Each division, therefore, is a self-contained organisation of about 15,000 men; it is fully equipped in all arms of the service and is trained by the Staff and General Officers who would lead it in war. When we consider this and remember that the men have the status of soldiers, undergo compulsory training in camp, and are to receive full modern military equipment—the advance which has been made over the old Volunteer arrangements seems enormous, and can be appreciated by none better than those who, like the writer, served as enthusiastic volunteers long ago.

The medical organisation of the Territorial Force merits more detailed treatment in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS.

To every division is appointed an Administrative Medical Officer with the rank of Colonel, who is a Territorial officer. He is on the staff of the General Officer Commanding of the division and has as staff officer a retired officer of the Royal Army Medical Corps, and as sanitary officer a specialist in hygiene in civil life, whose services are available in his special department.

The duties of the Administrative Medical Officer are similar to

those of a Principal Medical Officer of a Command. He is the commanding officer of the divisional corps of the Royal Army Medical Corps Territorials, which is composed of all the officers and men of the medical units of the division, and which has, besides, an Honorary Colonel who is an eminent member of the civil medical profession.

The Administrative Medical Officer is responsible, under the General Officer Commanding, for the training and preparedness for war—but not for the finance—of the field ambulances and general hospital as well as for the whole medical administration and sanitation of the division. A permanent office and a clerk are essential for his work, and have to be maintained on a very inadequate allowance.

The three field ambulances of the division have a similar organisation to that laid down for the regular Army, but their transport is their own, and their drivers are privates of the R.A.M.C.(T.). This, of course, opens up great possibilities, and these units can be worked up to a very high state of proficiency, provided they are furnished with the necessary wagons, equipment and material. A transport officer, who need not be a medical man, is allowed to each field ambulance, as well as a quartermaster.

The only "regular" with the Field Ambulance is the serjeant-instructor, whose position is the same as when he had charge of a brigade bearer company of fifty men only. One field ambulance is allotted to each brigade, hence the three in each division.

The mounted brigade Field Ambulance is a smaller unit; like the cavalry Field Ambulance of the regular Army it is organised for service with the mounted brigade of the divisional area; in other respects it is similar to the field ambulances. The remaining medical unit is the general hospital which belongs to the division in peace, but joins the corps troops in war.

Each general hospital is located at a convenient centre, and consists in peace-time of a nucleus of three officers and forty-three men, to be expanded only in time of war to full strength. For this purpose a staff of physicians and surgeons has been appointed *à la suite* of the hospital, ready to take up the military rank assigned them and to carry out the medical duties of the hospital in time of war. A nursing service on similar lines has also been formed, the sisters and nurses coming up for duty with the hospital in time of war. Many details remain to be worked out in connection with the general hospital, but the framework is at any rate provided.

With regard to the regimental medical service, the organisation

is being approximated to that of the regular Army. Medical men are now invited to join the Royal Army Medical Corps Territorials for duty with a particular battalion or unit, and interchange between the various branches of the medical service is permitted, but many men still prefer to be gazetted to regiments, and it will be some years before the regimental medical service becomes a homogeneous body.

The important subject of sanitation has not been forgotten; sanitary companies have been authorised in some divisions. For all units sanitary squads and men specially trained in "water duties" are required, and medical officers of health have received *à la suite* appointments to serve as sanitary officers in their respective districts in time of war.

We may here summarise the medical organisation of the division.

A.M.O., S.O., and Sanitary Officer	One General Hospital with *à la suite* Staff and Nursing Service	One Mounted Brigade Field Ambulance, three Field Ambulances	Mounted Brigade, three Infantry Brigades—R.A., R.E., A.S.C.	One or more Regimental M.O.'s to each unit.

à la suite Sanitary Officers.

To provide for proper training of the Royal Army Medical Corps Territorials the War Office has created a new organisation in each divisional area, known as a Royal Army Medical Corps Territorials school of instruction. This school consists of an adjutant, who is a Captain, Royal Army Medical Corps, and three Serjeant-Instructors—two Royal Army Medical Corps and one Army Service Corps for transport duties. It has its headquarters at the medical headquarters of the division, but it moves about, being attached to each medical unit in turn to give lectures, courses of instruction and promotion classes, both for officers and men, who thus have opportunities for training brought to their doors instead of having to proceed to some military centre. This new organisation is of the greatest importance, both in imparting knowledge and in ensuring uniformity of instruction; its work goes on all the year round, as all officers have to qualify by examination for promotion.

Finally a word as to the posts which the Territorial Force offers to Royal Army Medical Corps officers. There are two retired officers at the War Office, besides one Deputy Assistant Director-General, who are entirely given up to the Royal Army Medical Corps Territorials. Then there are the staff appointments for retired officers of the Royal Army Medical Corps, paid at the rate of £100

per annum, and the adjutancies of schools of instruction for Captains on the active list. These last appointments should be much sought after by young and energetic officers, as they give a wide field of work and much scope for originality and initiative. The staff billets appeal to recently retired officers who do not wish "to go on the shelf," do not desire private practice, and are sufficiently interested in the Territorial Force to be content with the very modest remuneration their country offers them.

A bird's-eye view of the Territorial Force is all that has been attempted, and all smaller details and local peculiarities have been designedly suppressed in order to bring out the main features of the scheme.

The Territorial Force has had bitter enemies and unwise friends, but now, if the authorities will take it seriously and supply the arms and equipment required, it will be a stronger rampart against invasion than England ever boasted of before, and will also educate the whole population in military matters, of which heretofore it has been densely ignorant.

THE ADAPTATION OF EXISTING BUILDINGS IN ENGLAND TO MILITARY MEDICAL PURPOSES.

By Captain E. B. WAGGETT.
Royal Army Medical Corps (T.).

In the course of a series of lectures in the First Division City of London Royal Army Medical Corps (T.) School of Instruction, it has fallen to my lot to speak upon this subject, Having no practical experience in the matter and finding but little in military medical literature which has any bearing upon the problem as it will present itself to the Territorial officer engaged in home defence, I have been compelled to fall back upon "common-sense" in writing this lecture. As one who enjoys some trained experience in another branch of medicine, I have learned to regard "common sense," unsupported by special knowledge, as one of the most fallible of guides; and since the Territorial medical officer must inevitably deal with the problem on active service, it seems to me highly desirable that he should without delay be put in possession of the guiding principles, by those who by trained knowledge or actual experience are qualified to furnish them. This paper, then, pretends to be in no sense an *ex-cathedra* contribution to military medical science, but is inserted rather as a decoy to elicit instructive criticism from the pen of the expert. For the sake of brevity the lecture appears in the form in which it was delivered to the officers and N.C.O.'s attending the school.

I can find no literature which has any special bearing upon the problem of the adaptation of existing buildings to military medical purposes, as it will present itself to the Territorial Service engaged in home defence. I am not aware that any man has had practical experience of dealing with it, as we shall be called upon to deal with it—that is to say, in a highly civilized, closely populated country with a temperate climate, and under the conditions which very recent advances in civil and military sanitation demand as essential. I have therefore to fall back upon personal knowledge of work in civil hospitals, nursing homes and private houses, supplemented by valuable hints kindly given me by Lieutenant-Colonel Melville, R.A.M.C., Professor of Hygiene at the school at Millbank; by our Adjutant, Captain Lloyd, R.A.M.C., and by several friends who have had experience in South Africa and elsewhere, and notably Dr. Stoker and Dr. Rolleston. We need concern ourselves to-night

only with the mobile hospitals—namely, the field ambulance and the clearing hospital—for it is understood that the general hospitals will be established on the hut system, and if the same arrangement is not adopted for the stationary hospitals, existing buildings no doubt have already been ear-marked for the purpose by the Army Medical Staff.

We have to consider what, from all points of view, is the ideal type of existing building; but for the sake of convenience let us narrow the field of choice by excluding that which is undesirable and to be avoided. We will deal with the precise criteria of the ideal later on; for the present let it suffice to say that we have to think of four chief considerations: firstly, the military exigencies; secondly, administrative facilities; thirdly, the welfare of the sick and wounded; and fourthly, the welfare of the civil community; for it must be remembered that a mobile hospital may have to remain in establishment for a considerable period of time in one place, and so may prove a source of danger to the civilian.

In the wars of the last century the first building pitched upon for the military hospital appears to have been the nearest available church. This structure is of all places the most unsuitable, at all events in the less clement seasons of the year. It is generally dark and always ill-ventilated. It has been constructed with a view to occupation for an hour or two at a time, and the change of its atmosphere depends upon gradual diffusion of fresh air, entering by narrow windows and doors, during the hours when it is not occupied. Those of you who have been through the sanitary class are aware that the chief hindrance to efficient ventilation lies in the inertia of air. Air is comparatively viscid and takes a good deal of moving. The ordinary natural ventilation which takes place in a large room—namely, the exit of heated air by windows near the roof and the entrance of fresh air by the doors or special openings—is apt to create a noticeable draught in certain areas, while the air in outlying parts of the room remains comparatively stagnant. Even in a fairly small room of some 5,000 cubic feet capacity and ill-constructed from the point of view of ventilation, I have daily experience of this fact; for while one-half of the room is kept fresh by the constant use of an electric fan forcing the air in from without, the atmosphere of the other half remains stagnant and unfitted for the use of a bedridden patient. The same defect is seen on a large scale in the House of Commons and the Stock Exchange, where extremely costly artificial devices fail to afford efficient change of air where it is most wanted, namely, at a level of from 3 to 6 feet above the floor.

I know of but one system of artificial ventilation by means of which a comparatively crowded room is kept in proper condition for prolonged occupation without evident draught. I refer to the Glover-Lyon system, which you may remember to have seen exhibited at the Tuberculosis Congress held in London in 1901. A modification of this system is in operation in the north room at the Royal Society of Medicine, but I understand that the cost of installation amounted in this room of only some 10,000 cubic feet capacity to nearly £80, a sum which no doubt could be reduced considerably if the installation was made during the erection of a building.

We must therefore seek for an efficient natural ventilation, that is to say, an intramural participation in the external air movements. This we cannot expect to find in any suitable degree, even in a modern church extensively furnished with Boyle's extractors and inlet tubes.

Except in high summer, the walls and floor of a church are damp and cold. No room with cold walls is a suitable place for sick men, for where such walls are at all lofty you will always find a cold down-draught within two or three feet of them; the foul, heated air has parted with its heat to the rafters and stones, and so falls in a cold cascade by force of gravity. Even when this down-draught is not perceptible you will find that sitting next a church wall in winter is capable of causing facial neuralgia on the corresponding side. The reason of this lies in the fact that your head inevitably radiates heat in all directions. Part of this heat is entirely absorbed by the cold wall, which radiates none back in return, and you are strikingly made aware of the fact that, for sanitary purposes, heat is of two kinds, convected (*i.e.*, roughly speaking, heated air), and radiant.

Surgeons called upon to do emergency operations in previously unoccupied rooms, the walls of which are cold, have a practice of quickly heating the air by burning a pint of spirit in a metal basin placed upon the floor. A room heated by this device feels almost unbearably hot for a short time, but the temperature rapidly drops, and we take pains never to leave the patient in such a room after operation, for the reason that the cold walls speedily absorb the heat from the air and later from the patient himself. If you are compelled to make use of a church as a ward, I would urge you to put your patients in the middle of the nave, as far removed from the walls as possible, and to get what good you can from the convected heat derived from the stoves.

This criticism of the air and warmth applies in a modified degree to town halls and concert rooms, and to all large buildings which are not specially designed for constant occupation. These large halls, moreover, exaggerate the very disadvantages which surgeons habitually experience in the large wards of a civil hospital, and you may know that most surgeons contrive, when they can, to place their more serious cases in the small wards which are often provided. Very critical cases we sometimes even take into private nursing homes. The reason for this caution lies in the fact that the nervous element is a matter of the utmost importance in a very sick man, and we sometimes enter a large ward in the morning to find that all the patients have had their night broken and their nerves shattered by the presence of one noisy companion—possibly of one in grievous pain. Any house surgeon who has been "warded" in a large hospital will realise the annoyance and disturbance caused by the admission of a new patient during the night. This nervous element is especially evident in the sick soldier, already broken by fatigue and privation.

The most emphatic drawback to the church and town hall lies in the circumstance that if one case of infectious disease either crops up or is inadvertently admitted, the whole number of your patients runs into danger of infection. A case of scarlet fever, small-pox, measles, pneumonia, diphtheria, tonsillitis, or wound sepsis, if left undetected in the ward for a few hours, will, in varying degrees, place the whole number of patients under suspicion, and, putting all other considerations aside, will render your hospital for a time immobile.

I have heard some of my friends discuss the adaptability of "Olympia" to the requirements of a general hospital for one of the London divisions. Of all existing or conceivable structures, this is probably the most ill-adapted building which could possibly be selected for that purpose. Nothing short of the most elaborate and expensive system of artificial ventilation will make it fit for hospital use.

In the single matter of administration, the large ward has the advantage of simplicity and economy in the work of the *personnel;* but seeing that our *personnel* is already suitably organised to meet our appointed duties, that consideration need not greatly concern us.

The central position of the town hall and other public buildings seems at first sight to be advantageous. It is, however, the reverse, for unless it be a large city building standing in its own

grounds, the town hall is usually situated in the market place, surrounded by the noise and dust of crowded streets. In the event of invasion of this country, every town and village will be crowded with refugees, and if you bring your patients into the centre of a town, you will bring them into the thick of a civil community subject to the dangers arising from a complete disorganisation of public sanitation, and almost certainly in a state of epidemic disease.

We will next consider the extreme opposite in the way of buildings, namely a batch of outlying labourers' cottages. The disadvantages we have already spoken of do not exist, but for other reasons the cottage is unsuitable for hospital purposes. Its small rooms are either close and hot, or cold and draughty, for the air of a very small room cannot be changed efficiently without creating a perceptible current. Often enough there is no fireplace. The windows are small and the corners are dark, and it is well known that daylight is the best destroyer of many disease germs, notably of the tubercle bacillus. Among a large number of cottages a certain proportion of rooms will prove to be incredibly unclean and infected with vermin, and one or more will have previously contained an infectious inmate. The stairs will be narrow and tortuous, and therefore impracticable for the carriage of stretchers. In this way it may come about that only a minority of the rooms will be, in any degree, suitable for hospital purposes, with the result that one orderly may have to attend to three or four houses. Meals will be cold, adequate supervision impossible, and administration in every way difficult.

The sole advantage in the cottage system lies in the comparative isolation of infectious cases. Against this advantage one must put the definite disadvantage that many of the sick-rooms may communicate directly with a cesspool by means of a rat-hole. Where earth closets replace the cesspool system, the patient runs an even greater risk, at all events in summer, by reason of the house-flies, for unless the latrine is kept under exceptionally careful conditions and dressed with some pungent disinfectant, this place provides the favourite breeding-place of these pests.

It is now known that, at all events in tropical countries, the house-fly lays her eggs, by choice, in human excreta. To put the natural history shortly: The female fly lays from 100 to 120 eggs in the latrine. In due course the contents of that receptacle are emptied and buried in a trench. The larvæ, for a period varying from five to fourteen days, according to the temperature, live and

flourish there, imbibing from their diet of excreta, typhoid and other bacilli. After a "resting," or pupal stage, lasting from three to five days, the mature flies emerge, struggling up through many inches of earth. They fly at once to the dairy, larder, kitchen, and sick-room, and so carry into the hospital whatever infection they may have about them. Maccabe, in his "War with Disease," belittles the danger of the house-fly, and points out that, like a cat, he is constantly cleaning his legs and his person.[1] Herein is an instance where "common-sense" and analogy prove dangerous guides, for recent investigation has proved that the fly has no control over the pathogenic bacilli which he carries, and cannot possibly remove them by any form of ablution. They live and flourish in his intestines, and he deposits them in a virulent state in his droppings, and where he dies there he leaves them, still living in his carcase.[2]

The latrine of a cottage is, then, a source of very real danger. A little calculation will show that your milk may be infected by a fly which has imbibed typhoid bacilli from the excreta of a civilian who died and was buried three weeks before your arrival—and whose very existence perhaps has been forgotten by his neighbours in the excitement of war, even if his case was ever diagnosed.

A single human dropping in the garden may be a source of danger, for if you dig up 6 inches of earth from below a dried-up, harmless-looking mass of fæces, you may find dozens of burrowing fly larvæ, ready in due time to emerge and carry infection.[3]

Flies render the farmhouse and its attendant manure-yard also unsuitable for our purposes, for though typhoid and dysentery are not likely to be found there, we must remember that these are not the only septic conditions of the bowels which we have to fear. We should also bear in mind that the good health of the habitual occupants of a house is no guarantee of the safety of new-comers. The farmer's family may be rendered immune to the ill-effects of certain bacilli by daily receiving small or "vaccination" doses of them, and the infection which is unable to create diarrhœa in the

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[1] Maccabe, "War with Disease," 4th edition, 1908, p. 10.

[2] The laudable efforts of the fly to keep his feet clean were, I understand, quite ineffectual in South Africa, for when the latrines were sprinkled with lime, a white film of that substance was found upon the meat.

[3] An important paper by Lieutenant-Colonel Aldridge on "Flies and Typhoid," Journal of the Royal Army Medical Corps, 1907, p. 558, should be read; also one by Major F. Smith, *ibid.*, 1907, pp. 190 and 447.

farmer's baby may carry off the sick soldier, shattered by fatigue and wounds.

Stables and barns present the same and other obvious disadvantages; they are dark and ill-ventilated, the floors are often soaked with urine, and the drain-traps, if present, are probably defective. Rats, mice, and other filth-carrying vermin cannot be excluded.

Shops and warehouses have many advantages; they may be light, airy, clean and adapted to easy administration. They do not, however, come near the ideal, for the reason that though the water supply, ablution and sanitary arrangements may be good in quality, they are insufficient in quantity for the needs of a large hospital. Moreover, they contain no beds and utensils and so impair the mobility of the ambulance, all the wagons of which must be unloaded to supply the deficiency.

The typical County Council school in a less degree suffers under the same criticism, and one may incidentally point out that a room with a skylight or with very lofty windows is undesirable. A skylighted room not only is excessively hot in summer and cold in winter, but a top light is at all times a source of great fatigue to a bedridden man.

Let us now look for the ideal. In considering this point we must put aside all civil hospitals, asylums, workhouses and large public schools, for these will be already more than fully occupied by civilian patients, drawn from a community under the stress of famine and epidemic, or else they will have been ear-marked by the Army Medical Staff for purposes other than ours. Our minds at once revert to the large, well-appointed private boarding school, a modern structure built upon a picked site. Schools like Sandroyd, near Cobham, or Locker's Hall, at Hemel Hempstead, leave absolutely nothing to be desired, and such places cause the mouth of the medical officer to water. But these cannot form our ideal for the reason that there are so few establishments of the kind to be found in any position where they are likely to serve our purpose, and you may travel 100 miles in the neighbourhood of London and not see one of them. The same objection, in a less degree, applies to the commodious country house, and to the hotel standing in its own grounds, and we must seek our ideal in some kind of building which is to be found everywhere. I think that the modern villa, built in groups or rows, may be said to fulfil that criterion, at all events in the south-eastern section of this country.

Before writing this lecture and being free of any previous bias or knowledge—having, moreover, but a few hours to prepare it—

I thought that a simple method of gaining some ideas on the subject would be to put a hypothetical case, and see to what conclusions it led.

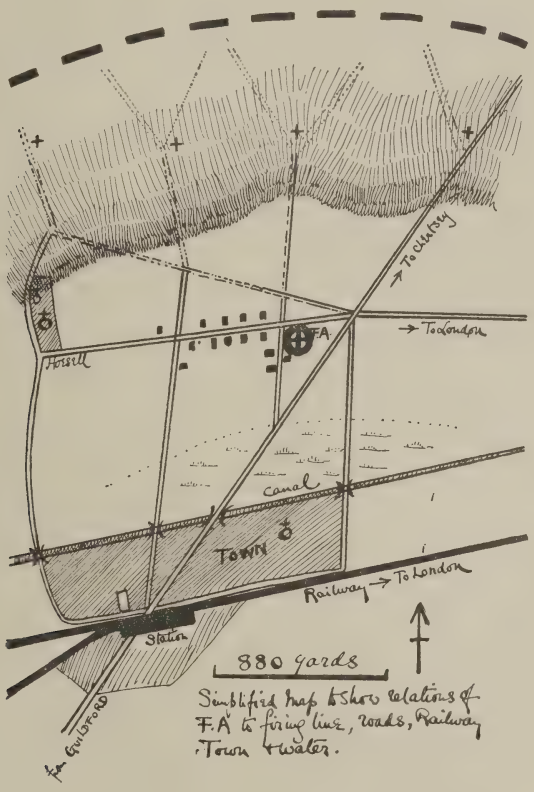
Let us suppose that we, as a field ambulance, are serving a brigade defending Woking Junction from an attack from the north. A rapid advance or retreat, after receiving or failing to receive reinforcements, is on the *tapis;* we are therefore to keep as mobile as possible and pitch no canvas. We may possibly, on the other hand, remain stationary for some days, and though we are to establish but one section at first, the whole field ambulance ultimately may have to be utilised.

Six conditions have to be considered in choosing a site; that is to say, proximity to the fight, access by road, water supply, cover, sufficiency of space, and visibility from a distance. These, as you all know, are laid down by military regulation, and as doctors we have other considerations to think of. But let us first take these regulation conditions in order.

The fighting line lies two miles north of Woking Station, and is extended a mile and a half from east to west beyond Horsell common, which slopes up southwards to a ridge in the rear. The nearest available building is in rear of this ridge, and farther than one would wish from the fight, but a series of roads and good tracks fan out from a point near the convergence of the Chertsey-Guildford and Horsell-London roads and leave the wagons but a few minutes' journey from suitable collecting posts. Any site north of this would be swept by rifle fire; moreover, the position of these two main roads meets the requirements concerning advance and retreat, the former either north or west, the latter either east or south, respectively, on London or Guildford and Aldershot.

Within a few hundred yards of this spot one finds a number of comfortable modern villas—all, needless to say, approached by good roads. To the south of them, some 700 or 800 yards distant, runs the Aldershot Canal, the water of which must be made to serve, should the town water-supply be destroyed. A certain group of these villas is very fairly sheltered from stray rifle fire. From gun fire no building in the neighbourhood can be said to be covered, but inasmuch as the enemies' objective would be the railway junction, these villas, lying 1,500 yards from the target, are less likely to be hit than the Town Hall situated close to the station. The section could readily be expanded to the full field ambulance, for the reason that there are a dozen or more almost equally suitable houses, distant from one another about fifty paces; that is to say,

near enough for the purpose of easy central administration, and yet sufficiently distant not to catch fire from one another should one be hit by shell. The distinguishing flags and lights on a flagstaff mounted on a roof would be visible from a great distance. These houses are well built and comparatively new, situated on an upland gravel soil, not surrounded by trees, and well removed from the bog-



land near the canal. Half a mile separates them from the nearest small dwellings on the outskirts of the town, presumably containing a crowd of infectious civilians. The close proximity of the main road, some 300 yards distant, makes it probable that the supplies would be duly received. Both road and railway are available for the evacuation of sick. Improvised transport is as likely to be found in the town as anywhere, while the prosperous character of the houses in the neighbourhood promises offers of civilian help from

doctors and nurses, should a move be imperative before evacuation had been carried out.

The situation seemed, then, to be very near the ideal, and the question arose whether the houses would prove the same. The owner of one of them very kindly allowed me to go over his rooms, and, moreover, lent me the architect's plans, which are here reproduced.

On *a priori* grounds, gained from a knowledge of nursing homes, I had imagined that a comfortable modern villa was the ideal building for a short-stay hospital. Such a house is built to suit the health and comfort of the freest man in the community, that is to say, the well-to-do, intelligent citizen, who being unhampered by the exactions of pomp, need not erect immense and often gloomy apartments; and living well within his means, will not put up with small draughty rooms with their jerry-built walls and roofs, hot in summer, cold in winter. His rooms are large enough to be easily ventilated, there is a fireplace in each and the windows are arranged to catch the sun and avoid the winds from north and east, and may, therefore, be kept wide open. There is a main water supply and, often enough, gas or electricity is laid on. If there is no main drainage the cesspool is well kept and far removed from the house. Access by road is usually good and the lawn gives space for the parking of wagons. The house, being a villa and not a country seat, is separated from its neighbours by but a short distance, and so can form part of a larger administrative unit. Finally, such a dwelling is to be found almost everywhere in the home counties; of this you may convince yourselves by studying a large scale map of any piece of country, except that of the broad stretches of moorland occupying the middle of the weald and the neighbourhood of Bagshot.

If the villa is already inhabited so much the better, for then you will find its sanitary arrangements in good condition, its cupboards supplied with linen and utensils, and last, but by no means least, the rooms will be in that state of perfect order and cleanliness which results from the work of a staff of trained servants under the supervision of a careful mistress.

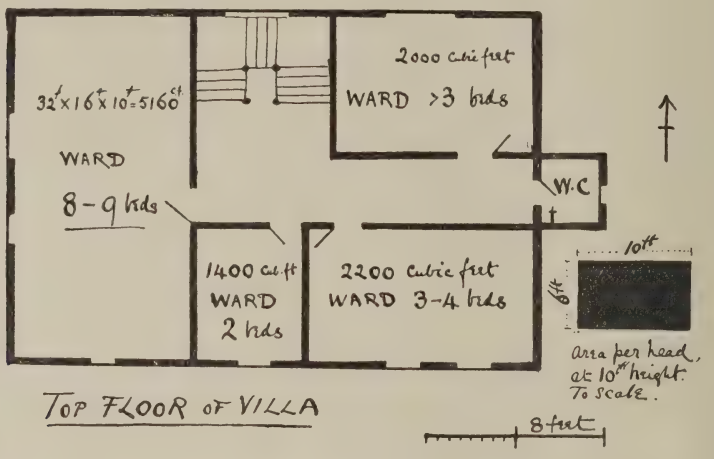
The villa which I examined fulfilled all these expectations and, curiously enough, proved to have the exact accommodation of one section of a field ambulance, that is to say, a hospital of fifty beds, with operating room and administrative offices. Two or three villas, distant but a stone's throw, appeared to be of much the same capacity.

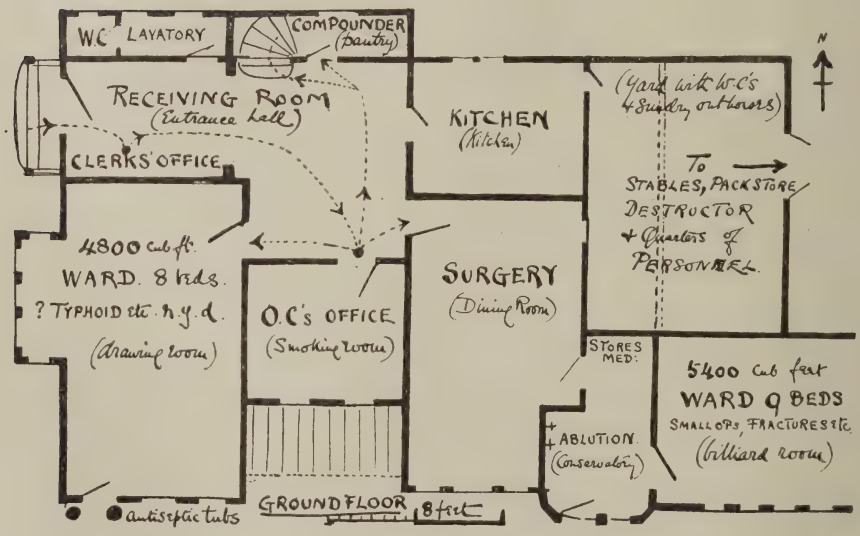
The house would figure in the agent's specification as one containing three reception rooms, billiard room and offices on the ground floor; five bedrooms and bathroom on the first floor, and four bedrooms on the top or attic floor—nine bedrooms in all. There were at least four water-closets, numerous sinks and taps in various places, and a well-arranged kitchen department and stables. The staircase was broad and shallow and offered no difficulty to the passage of stretchers.

Let us first consider the bed-capacity of the house and the allocation of beds to rooms. In most civil hospitals the cubic space allotted to each bed is fully 1,500 cubic feet, but the magnitude of this figure is in a considerable measure due to the lofty construction of the wards. Every householder knows that great height in a room is not all gain, and that with intelligent ventilation a room of moderate size, and not more than 10 feet high, is often fresher to live in than one of 15 feet—and you may have noticed when standing upon a ladder hanging pictures in a lofty room that you come into an upper region of stagnant, over-heated air, which can be of no service to health. Indeed, this stagnation of air is the rule and not the exception where a lofty room has not been built with a special eye to sanitary ends. In a room, say, 16 feet square, the ventilation by window and chimney can be easily arranged to give efficient change of air without perceptible draught, although the height may be only 9 feet. This is not the case in very large rooms unless they are specially built for hospital purposes with an excessive number of windows, for the air remains stagnant in some parts while an unwholesome draught is experienced in others. In an improvised hospital ward, especially if, as is the case in mobile hospitals, it is not to be used for infectious diseases, we can dispense with so large a number of cubic feet per bed, and in the admirably organised Imperial Yeomanry Hospital at Deelfontein, South Africa, the huts were arranged to give 600 cubic feet per bed, while the figure at Mackenzie's Farm was nearer 400. Lieutenant-Colonel Melville, Professor of Hygiene at the Royal Army Medical College at Millbank, considers 600 cubic feet per bed suitable for a temporary hospital. In this plan of the house, for the sake of simplicity, I have taken the height of the rooms to be 10 feet, although on the ground and top floors they were actually much loftier.

Let us consider the bed capacity of the large attic—32 by 16 feet by 10 feet = 5,160 cubic feet. Eight beds at 600 cubic feet each = 4,800 cubic feet; the attic will therefore accommodate

eight, or at a pinch nine patients. Going through all the ten wards indicated on the plan and using the most liberal scale, we are only three beds short of the fifty needed. As to the beds themselves, the existing ones would be utilised for serious cases, and





mattresses or light bedsteads commandeered from neighbouring houses if it was thought desirable. The presence of existing furniture is the one drawback to the inhabited villa, but this embarrassment can be minimised by compactly parking the heavier

pieces in the centre of the room. As a compensation for this labour one finds abundance of clean linen, blankets, towels, and washing apparatus.

On the ground floor, the entrance hall was very suitable for the receiving room and clerks' office. The Commanding Officer's room was in touch with this, and the pantry, opening on the hall and supplied with water and sink, was admirably suited for the compounder's store and dispensary. The well-lighted dining room was adapted to the requirements of a surgery for small operations, dressings and medical inspection—ablution arrangements being close at hand in the conservatory.

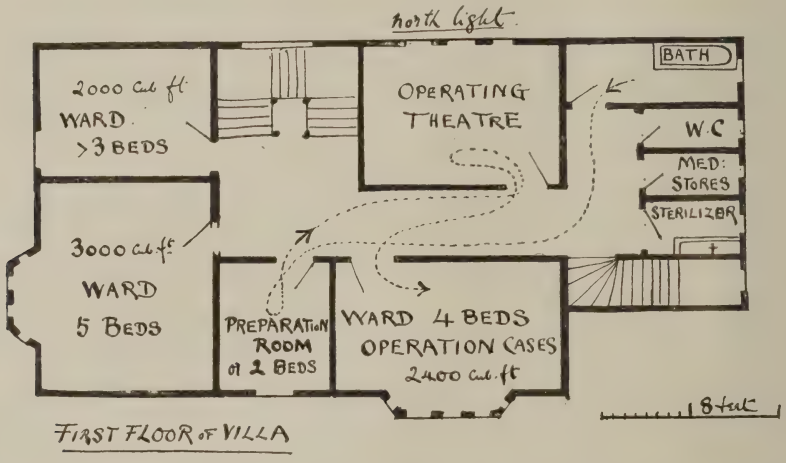
The drawing and billiard rooms were convertible into wards, and the former was specially adapted to cases under suspicion of typhoid and dysentery awaiting diagnosis, since excreta and soiled linen could be taken direct to the antiseptic tubs placed outside in the garden, through the French windows, without passing through the house.

The kitchen and its adjuncts would naturally serve their original purposes; it would be well to commandeer the services of the cook, a person likely to understand the idiosyncrasies of the flues, oven, and hot water supply.

The quartermaster's stores should be kept in the wagons untouched; an outhouse should serve the function of packstore, for soldier's clothing must be viewed with suspicion as a source of infection and should not be kept under the roof of the hospital. Bedpans and soiled linen should, after immersion in disinfectant, be boiled in the copper connected with the coachman's house, before returning to the wards or passing on to the laundry. The *personnel* would find adequate quarters in the coachman's and gardener's houses. The greenhouse furnace supplied an efficient destructor for refuse and dressings, and a small laundry completed the equipment.

The plan of the first floor shows a room with a north light (almost the only room open to danger from stray rifle fire) well suited for an operating theatre. Close to it was a bathroom, a storeroom for medical stores and a small pantry with a sink, suitable for the installation of the steriliser and for washing instruments. Across the passage was a dressing-room and a bedroom, suggesting the preparation room and a small ward for severe operation cases, this section of the floor forming a compact surgical department, where serious operative work could be carried out, well away from the disturbing influences of the receiving room.

As to the preparation of the individual rooms, one may take it, as a general rule, that unless cleaning is done really thoroughly, it is best to leave the dust upon walls and pictures undisturbed, and for a temporary stay of two or three days the carpets and furniture in many of the rooms may be left *in situ*. The receiving room and surgery, the scene of constant activity, have to be cleared. The operating and preparation room must be thoroughly purified in a surgical sense. Fumigation is useless, and these rooms must be stripped bare, and their floors, walls, ceilings, doors and windows carefully scrubbed with saponified cresol, irrespective of the nature of their surface.



The cracks in an ordinary deal flooring cannot be cleansed effectually. Sheets damped with izal should therefore be spread over the floor of the operating room, and mackintosh sheeting should be placed under the operating table, to prevent the soakage of infective irrigations into the woodwork.[1]

In spite of the distribution of beds in ten separate rooms, a glance at the plans will show that six ward orderlies have no difficulty whatever in looking after the fifty sick, the slighter cases being accommodated on the attic floor.

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[1] The writer, who has had to perform many hundreds of operations upon improvised tables, ventures to suggest that the table provided in the Field Ambulance Equipment is likely to militate against the success of the surgeon and the well-being of his patients. He is aware that extensive operative undertakings do not form part of the special function of a Field Ambulance; at the same time it is evident that the crisis in the career of a certain number of cases must take place in the operating tent—and the issue of that crisis must often depend upon the facility and celerity with which the patient can be made to

Although the sanitary system of the house was connected with a main drainage, the town would be in no danger of typhoid infection if suspicious dejecta were treated under regulation, for in military service every patient with fever lasting more than twenty-four hours is regarded as a potential typhoid case, and his excreta are dealt with accordingly. Finally, the civil community would be subjected to a minimum of stress by the commandeering of such a house, for but one household, consisting of perhaps seven or eight souls, would be dislodged.

One may say that this building, with the exception of two small inconveniences, namely, the slightly undue distance from the firing line and the presence of unnecessary furniture, exactly fulfilled the four conditions mentioned at the outset of this lecture—namely, the military, the administrative, the hygienic, and the civil.

I submit the conclusion that it is in the group of modern villas that we are to find the ideal buildings for adaptation to military medical purposes, as we are likely to deal with them in our mobile units, working in the home counties of England; for both on *a priori* grounds and in actual fact they fulfil our requirements.

When the day comes, the Territorial officer, left with no specific orders, may find no such group available. He must then make the best of what he can get; but his task will be very much simplified if he has already conceived an idea of what he desires. He may find his buildings lacking a main water supply; in this event he will regard all well-water with suspicion and pass it through the filter or the boiler. He may find a marked disparity in the advantages of a number of houses which are built in a group; he will then consider that his primary function is to get his sick well and return them to their units with the least possible delay; consequently he will, on sanitary grounds, pick out for his use certain houses irrespective of their mere propinquity.

In a word, I think he will be wise, so far as military conditions permit, if, in his choice of site and construction, he takes as his guide the prosperous citizen, and turns him out of his country villa.

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assume the Trendelenberg position. The present operating table weighs 23 lb.; an additional 15 lb. weight and £6 or £7 cost will represent one of the adequate portable tables already in the market, such as most surgeons possess and put upon their carriages as easily as a portmanteau.

The present Field Ambulance arrangement moreover effectually seals two of the boxes or baskets at the moment when their contents may be especially needed. Operations performed in a stooping position are very fatiguing to the surgeon and are apt to miscarry.

THE CARE OF THE FEET ON THE MARCH.

By Lieutenant-Colonel C. H. MELVILLE.
Royal Army Medical Corps.

It seems hardly necessary to insist on the paramount importance of the feet of the soldier, especially of the infantry soldier, and to devote time to writing specially on this subject would seem almost an impertinence (which as a matter of fact it should be) did not one know how often the care of this portion of the body is forgotten.

What the horse is to the cavalry soldier, his feet are to the infantry soldier, and as it is a point of honour with a horse-man to look after his horse before he looks after himself, so it should be a matter of obvious common-sense for the foot-man to look after his feet before he looks after his stomach.

When a man falls out of the ranks footsore, the fault lies in one of three directions, either in the condition of his feet, in the condition of their coverings, that is, the boots and socks, or in a combination of these. I propose to consider these in the above order.

Considering firstly the feet, the fault here may lie either in the formation of the foot or in the condition of the skin. As regards the formation of the foot, it is obvious that except in extreme cases of deformity, as of hammer-toe or ingrowing toenail, not much can be done directly to the foot; the remedy must be sought in the adaptation of the boots to the feet. The importance of the formation of the foot as affecting a man's efficiency in the ranks is apt, however, to be overlooked by recruiting officers; and it is worth while insisting that this point should be given almost more weight in the recruiting of an army that is not intended to be mobilised, except in actual view of hostilities, than in the case of a regular force permanently embodied. If a man should get into the regular army with a badly deformed toe there is always the opportunity of remedying the error by operative measures long before the man is actually required in the field. But with a second-line army this is not so. A man may be able to stand the comparatively easy work of his annual camp with an amount of deformity which would speedily incapacitate him in the earlier days of mobilisation. Hospitals in the field are, it need hardly be said, not intended for the treatment of long-standing deformities, and the only thing to be done with such a man is to discharge him just at a moment when

his services are most needed. The formation of the foot, then, is a point to which the most careful attention must be given during the physical examination of recruits.

If the fault does not lie in the formation of the foot it must lie in the condition of the skin; and here the consideration which is most important is cleanliness. It may not be true, absolutely, to say that clean feet are sound feet, but it is absolutely true to say that dirty feet are unsound feet. That may be taken as an axiom, and, therefore, the first cardinal point that the medical officer in charge of an infantry unit must insist on (in this connection) is the paramount importance of cleanliness of the feet. The feet should be washed with clean water and soap every day if possible, or if this is impossible, as on Service it may sometimes be, on every possible occasion; and it need hardly be said that not less important than washing is drying after washing, and especially drying between the toes. It is important also to insist on the necessity for the complete removal of all remains of soap from between the toes before drying. The above measures—the frequent and careful washing, and careful drying after washing, of the feet — are important, and their importance must be impressed on all men, and frequent inspections to see that they are universally carried out should be instituted. In some cases this is not sufficient. It is necessary in addition to find out those men who suffer from hyperhydrosis, and these should form the particular care of the medical officer of every infantry battalion. He will probably find about two men in every company, say between fifteen and twenty men in a full battalion, whose feet sweat profusely in spite of periodical washings. These men he should see every day as well as immediately after arrival at camp or quarters at the end of a march. The washing of their feet must be carried out under his immediate supervision, preferably with some mild astringent and antiseptic, such as weak solution of permanganate of potassium, or a 0·5 per cent. solution of formaldehyde. The use of astringent ointments or powders of a mildly antiseptic and non-irritating nature is to be recommended in these cases, but far more important than any medicinal application is the close personal supervision by the medical officer of the battalion of the process of cleansing the feet. The feet of the battalion as a whole may be left to the care of the company officers, but those of the men afflicted with profuse sweating must be the care of the medical officer in person.

The following hints may be of use as regards suitable applications for the feet, to be applied more especially in the case of men

suffering from hyperhydrosis, or for general use in hot weather. In the German army a mixture of salicylic acid and talc, three parts of the former to eighty-seven of the latter, with the addition of starch ten parts, is used. Drs. Troussaint and Schneider, of the French army, recommend the careful swabbing of the feet with cotton-wool soaked in 10 per cent. solution of chromic acid, a weak dilution being used in the case of excoriations being present. This should be repeated in a fortnight or six weeks. This proceeding is also a regulation one in the German army. Dr. Vaillard recommends the use of formalin in somewhat strong solutions, rising even to 30 per cent. in cases where it is well borne. It need hardly be said that the use of any such solutions should be restricted to cases where it is absolutely necessary, and remain under the personal supervision of the medical officer.

The question of corns may be alluded to; it is not wise to leave these entirely to the care of the battalion chiropodist, even supposing such a person to exist. Unskilful cutting may cause a serious injury, and the operations of the chiropodist should, therefore, be carried out under the supervision of the medical officer.

We now come to the coverings of the feet, and firstly, then, as regards the socks. In reference to the number of socks a man should possess, no man is an efficient foot soldier who does not start at least with two pairs of well-fitting undarned socks. Two at least he must have, since one of the most important points in the care of the feet consists in putting on a cool, dry pair of socks after the former have been washed. Quite apart from the effect on the feet of putting on hot, damp and dirty socks after washing, which this change avoids, the general refreshing effect of clean, dry socks is very considerable. The socks also should be undarned to start with, since while the foot is still unhardened by the march, it is liable to suffer abrasions from the roughness of the mended surface, while in its hardened condition a few weeks later the same effect would not be produced. The socks after removal should be dried and then carefully cleansed of all dust, &c., by shaking and rubbing, and any hardened patch carefully kneaded between the fingers until the substance of the sock is soft and pliable again. Washing of socks is a matter that has to be performed with the greatest care and certainly should not be performed very often. Careful drying and cleaning as above described is sufficient for several days at least. The material of which the socks are made should not be too thin, and too thick a material is equally an error. Well-made, knitted, woollen socks

of medium thickness are undoubtedly the best. Cheap woollen socks are rarely well made or finished, and invariably shrink in the wash, and it is probable that in ordinary weather stout merino socks are preferable to these. For those who can afford it there is nothing more comfortable than two pairs of thin socks worn one over the other, but of course this entails four pairs in all. Every foot soldier should be able to darn his own socks, and be provided with materials for this purpose, and at the periodical foot inspections, socks should also be examined to see that holes are not allowed to go beyond repair. In the absence of socks, it is worth remembering that an excellent substitute can be made of linen or cotton cloth, or fairly thin flannel. A piece about the size of an ordinary triangular bandage should be taken. The foot is placed on this with the heel in the centre of one of the sides at a distance of about four inches from the edge. The edge is then brought up the back of the foot to a little higher than the top of the boot, and the free ends of the bandage folded round the foot. The size of the material should be such that when the edge is on a level with the top of the boot the point should still remain long enough to come over the toes to a spot in front of the ankle level with the edge behind. The use of these foot cloths is not uncommon on the Continent, and I can testify from personal experience over about 600 miles of rough walking that if well applied they are quite efficient substitutes for socks. The necessity for a spare pair of foot-cloths, to be put on on arrival in camp, is as imperative as in the case of socks. They should be cleaned in the same way. Soaping the inside of the socks is a useful precaution, especially when these are old or rough with darns.

We come now to the consideration of the boots. The question of the supply of boots to men of the Territorial Army is still, I understand, *sub judice*, but in any case every man should be prepared to turn out with one sound pair of walking boots, sufficiently worn for the feet of the owner to be accustomed to them, and in good repair. To start marching with soft feet, in a new pair of boots, is suicidal. The new boots served out on mobilisation should be worn for ordinary drills till the feet become accustomed to them, but for serious marching in the early days of mobilisation the boots worn should be those to which the feet are accustomed. Every Territorial soldier who wishes to keep himself efficient and in readiness to turn out at short notice should, if he can afford it, keep always one pair of good boots in good repair, and in regular use, for this purpose. The best boots are those

which approach as nearly as possible to what is called the rational shape. That is to say, they should conform in plan as nearly as possible to the outline of the sole of the foot, taken by tracing round the foot when planted firmly on a piece of paper. The toes should be bluntly rounded, not pointed, and when laced up there should be room in the boot for the foot to freely alter its shape in the course of the ordinary movements of walking, but without any actual movement in the boot. The heel should be broad and not, it need hardly be said, high. Civilised man has become habituated to having the heel of his foot raised slightly above the forepart, and it is impossible for him to return to the natural condition of the heelless savage. The height of the heel should be limited, however, and not more than twice the thickness of the sole. The addition of a metal plate saves wear, and has undoubted advantages in this direction, but it must be remembered that such an addition adds markedly to the shock felt when the heel is brought to the ground, especially in a laden man, not habituated to the carrying of weights. The sole should not be too thick, since this means weight and lack of pliancy. All boots should be sewn, not pegged. The sole may be furnished with nails, but these should not be hob-nails, since these are apt to fall out and leave holes which permit of the entry of water. Coming now to the upper leathers, these should be stout and pliable, and preferably cut as in the ordinary shooting boot with a fixed tongue. They should not be blacked, but dressed with some oil or dubbin. This is most important, since it prevents the leather becoming sodden and hard. It is better on the whole not to have hooks to facilitate lacing. These are doubtless very convenient, but if putties are worn the pressure of the putties on the hooks is apt to cause injury to the ankle. It is, above all things, necessary to keep the boots as light as possible consistently with strength. Viry is responsible for the statement that every additional ounce carried on the boot is equivalent, as regards its effect on the wearer, to a hundred times that weight carried on his back, and though this may savour of exaggeration, it must be remembered that this additional weight has not only to be carried but lifted a height of 340 feet in every mile.

Writing for professional men, it is hardly necessary to speak of the treatment of injuries to the feet, blisters, abrasions, and so on, but it is important to impress the fact that men should be warned not to treat themselves. Self-treatment of a blistered heel, which usually consists in pricking it with a septic needle,

is very likely to result in admission to hospital for a tedious ulcer. A small blister or excoriation of the heel may seem to the enthusiastic surgeon, anxious to show his skill in the treatment of gunshot wounds, or the keen sanitarian looking forward to dealing with the large problems of disease prevention, matter too trivial for him to expend much time or trouble on, but it cannot be too strongly emphasised that no injury to the foot of a foot soldier can be looked on as trivial. What the total loss to an army from these causes may amount to is rarely realised, but the following facts are, however, worth remembering. The German army in the earlier fighting of the Franco-German War lost from killed and wounded rather over 60,000 men. In the same period 30,000 men were incapacitated from duty by injuries to the feet—rather more than half as many again as were lost in the most sanguinary engagement of the war, the battle of Gravelotte.

Note.—This paper has been written chiefly with the view of bringing to the notice of medical officers of the Territorial Forces the great importance of looking after the feet of their men. This importance is, of course, known to all officers of the Royal Army Medical Corps, but I may perhaps be forgiven for saying that, though it is known, it is not always remembered. The duty of looking after the feet of the infantry soldier is too often left to the regimental chiropodist—an excellent person, no doubt, but not one who can safely be entrusted with the sole care of the most important limb of the most important man in the army, the private man in the ranks of the infantry.

HINTS ON CAMPING ARRANGEMENTS FOR SANITARY OFFICERS.[1]

By Captain R. TILBURY BROWN.
Royal Army Medical Corps.

This paper is more especially applicable to camps in England, and is divided into four parts:—

(1) Selection of camp site.
(2) Duties before arrival of troops.
(3) The camp.
(4) Details of sanitary methods.

PART I.

Selection of Camp Site.

If possible, select the site in company with the Royal Engineer officer, the Army Service Corps officer, and the Adjutant and Quartermaster of the regiment concerned.

It may also be of advantage if the local medical officer of health and the owner of the likely ground, or his representative, are present.

The chief things to be considered are:—

(1) Is the ground suitable, having regard to the following points:—

(*a*) Size.
(*b*) Soil, subsoil and surface drainage.
(*c*) The water supply.
(*d*) The latrines.
(*e*) Facilities of approach.
(*f*) Facilities for obtaining shelter, food, fuel and straw.

(2) The waste water.
(3) Position of cook-houses, institutes and messes.

(1) (*a*) *Is the Ground large enough?*

Extract from Field Service Pocket Book:—

Unit	Minimum camping space in yards. Length	Depth
Army Headquarters	100 ×	100
Divisional Headquarters	50 ,,	100
Brigade Headquarters	30 ,,	50
Cavalry Regiment	161 ,,	150
Cavalry Squadron	55 ,,	150
Battery or Ammunition Column	75 ,,	150

[1] This paper has been written with a view of giving medical officers of the Territorial Force practical hints on camp sanitation.

Unit	Minimum camping space in yards. Length	Depth
Field Troop	50 ,,	50
Field Company	35 ,,	150
Battalion Mounted Infantry	200 ,,	150
Infantry Battalion	65 ,,	150
T. and Supply Company (I. company)	75 ,,	150
Divisional T. and S. Column	225 ,,	150
Army Troops T. and S. Column	150 ,,	150
Field Ambulance	120 ,,	200
Cavalry Field Ambulance	63 ,,	122
An Infantry Brigade in one Line	280 ,,	150
A Cavalry Brigade in one Line	515 ,,	150
General Hospital	400 ,,	250
Horses require each 6 feet × 18 feet		
Mules ,, ,, 4 ,, × 15 ,,		

The minimum spaces given above are only applicable when the ground is particularly suitable for a camp; if the ground is not very good they are insufficient.

If *shallow latrine trenches* are to be dug, add to the above depths: Number of probable days of occupation × 2-3rds = extra number of yards required.

Example:

Infantry battalion camp for fifteen days.

Minimum space (per table) = 65 × 150 yards (depth).

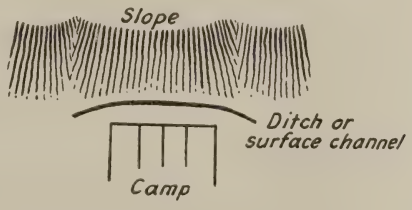
Depth of trenching ground for fifteen days = 15 × 2-3rds = 10 yards. Therefore, total minimum space = 65 × 160 yards.

(1) (*b*) *As regards Soil, Subsoil and Surface Drainage.*

A most important point to consider is the surface drainage.

Choose level ground on the top of a rise, or a gentle slope from the top of a rise. Grass-covered ground is the best. Choose drained grass land, if possible; this may be indicated by the presence of ridges and furrows, running parallel.

Avoid flat ground at the base of a slope, but if this is unavoidable a ditch should be present or a surface channel must be made between the slope and the camp.



Avoid a steep slope, newly turned soil, low meadows and clay soil.

Avoid a recent camping ground, but if this is unavoidable, keep clear of old latrine sites, burn the ground over old latrines or urinals, and clear away and burn all refuse.

Plans of camping grounds should be kept in the Brigade Office, or office of the local District Officer, Royal Engineers, showing the exact position of latrines, refuse pits, &c. Should a camp have to be pitched on previously used ground, the plans should be consulted in order to avoid the old latrine sites, &c.

(1) (*c*) *The Water Supply.*

Ascertain the nature of the water supply of the adjacent town or village, and the relation of the site to it. Take care that the site is not on the collecting area, whether for a town or for the wells of adjacent houses.

If there is a municipal water supply it may be possible to get the water piped to the camp. Place the site as near as possible to existing pipes.

If the supply is from wells: (*a*) See that there is no obvious pollution. If pollution is possible take care that the site is not on ground sloping towards the wells. Arrange with Royal Engineers to have the wells fenced off and covered, and any special precautions taken that may be required to prevent surface pollution (see Part II.). Later arrange with the General to have the wells guarded by a sentry.

(*b*) Take samples of water for analysis in the manner described in Royal Army Medical Corps Regulations, Appendix No. 3.

(*c*) Ascertain amount of water in the wells.

(*d*) Obtain local information as to effect of pumping on the level of well water. This is necessary in order to know the daily supply available.

(*e*) In case of wells running out, note likely situations to obtain water by sinking Norton's tubes. These may be indicated by midges swarming over certain spots; by grass being long, luxuriant, and darker; by mist rising over certain places in the evening, and by any obviously damp ground.

If the supply is from a spring: (*a*) Ascertain whether the spring is intermittent or constant, shallow or deep.

The temperature of the water from a shallow and intermittent spring varies with the atmospheric temperature; whereas the water from a deep and constant spring is comparatively cold in hot weather and hot in cold weather. The flow from a shallow and

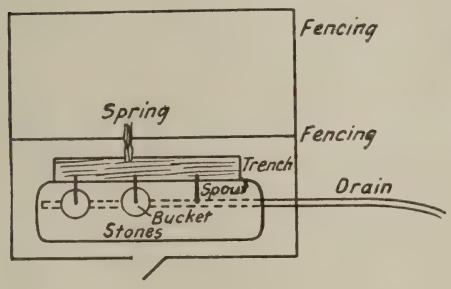
intermittent spring varies with the local rainfall; whereas the flow from a deep and constant spring does not.

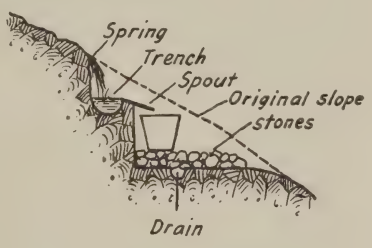
(*b*) Note likely causes of contamination on the collecting area.

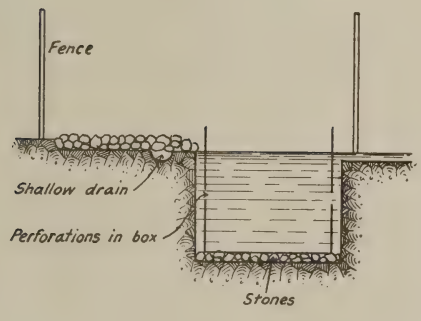
(*c*) Measure the rate of supply. If the spring is small, collect the water in vessels of known capacity for a certain time. If the spring is large measure the flow in the manner described as for streams.

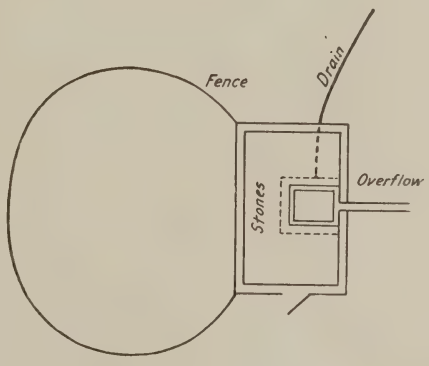
(*d*) Fence in the spring-head, clear away undergrowth and rubbish, and later, if necessary, place a sentry at it.

If the camp is for temporary occupation level off and drain the surrounding ground, so as to give the water parties a dry ground to work on and prevent pollution of the spring.









Render the water easily obtainable by cutting away the ground under the spring so that buckets can be placed to catch the water Or sink a barrel or box at the spring-head into which buckets can be dipped.

If the camp is intended for prolonged occupation sink at the head a barrel from which the water can be pumped to the camp.

If the supply is from a stream or river: (*a*) Go up the stream

for at least a mile; note any obvious pollution, and ascertain if there is any possible source of contamination.

Practically no rivers in England are fit for drinking purposes without treatment, and most streams are unfit.

(*e*) If the stream is small measure its supply. Pace out 10 to 40 feet where the flow is uniform, where there are no eddies, and where the depth is fairly constant. Measure the width and depth, then float a light piece of stick or paper over this measured area and note the time taken. Take four-fifths of the surface velocity as representing the average flow.

Water Supply for Ablution.—Ablution water should be taken from the same source as the drinking water, but this is seldom possible unless the water is obtained from a municipal supply or from large springs or wells. If a separate water for ablution purposes is pumped to the camp it should be stored in tanks and piped to the ablution benches. River water must be clarified before storage or use.

If water taken directly from a stream or river must be used for ablution purposes; note the best position for this purpose and also select a place further up-stream for watering the horses (see Part II.).

Amount of Water Required.—The minimum is ½ gallon per head per day. For drinking and cooking 1 gallon per head per day should be allowed. For all purposes 5 gallons per head per day should be provided, but if baths are erected 10 gallons per head will be required. A horse, mule or bullock drinks 1½ gallons at a time and takes three minutes over it. In standing camps 10 gallons per horse should be provided.

(1) (*d*) *The Latrines.*

Method of the Disposal of Excreta.—(1) If the site is near a town and the camp is to be occupied for some time, the disposal will probably be by the *dry-earth removal system.* Under these circumstances a contractor is usually employed by the Army Service Corps, and the following conditions should be observed :—

(*a*) The number of buckets provided to be double the number of latrine seats in camp.

(*b*) Removal to be daily after 10 p.m.

(*c*) When buckets in use are removed clean ones containing a little dry earth and lime to be placed in position.

(*d*) The earth to be dry and sifted through a ½-inch mesh.

(*e*) The supply of earth to be kept in camp under a covered shed, which must have two compartments for storing earth. (This allows one supply to get properly dry before the other is used.)

(*f*) Receptacles to be provided for earth.

(*g*) A scoop to be provided for each receptacle.

(*h*) Excreta to be removed at least 1 mile from the camp.

Latrines should be placed 100 yards from tents or kitchen, and to leeward of the camp.

(2) *The Shallow Trench System.* This is the best all round, and the amount of ground required is very small.

The frontage varies with the number of men. It is usual to have a trenching ground for each unit and to dig trenches for 5 per cent. of the men. The more men there are the smaller the percentage of trenches it is necessary to have; 3 per cent. is ample for 500 men. Calculating on the basis of 5 per cent., to obtain the frontage of ground, multiply the "hundreds" of men by 6; this gives the frontage in yards, but only holds good when trenches are dug with a 2 feet 6 inches interspace.

If latrines are to be placed in rear of the units, there is always enough frontage, even with the minimum camping area, so that the depth only has to be considered. This varies with the length of occupation of the camp. When trenches are dug in the manner described in Part IV., to find the "depth" of trenching ground required take two-thirds of the probable number of days of occupation, this gives the depth in yards, and the actual amount of ground which will be trenched; but it is well to allow a few yards in each direction as a margin for errors. On irregular ground or in a wood a greater area must be allowed. Undergrowth, gorse, heather, &c., must be cleared before the trenches are made.

Officers and men require separate trenching grounds; one trench for field officers and four trenches for the remaining officers will usually be sufficient.

Trenches for N.C.O.'s should be calculated on 5 per cent. of the strength. Frontage: Two trenches require three yards; four trenches require five yards; six trenches require eight yards; eight trenches require ten yards. Depth as stated above.

Position of Trenching Ground.—The N.C.O.'s and men's trenches are generally placed close together. If units are isolated, place the trenches on the most suitable site irrespective of its relation to the aspect of the camp. If units are in line the trenching ground should be in rear of the camp. The officers' ground should be near

their tents, if possible in front or to a flank of the camp. The nearest part of the trenching ground should not be less than 50 or more than 100 yards from the nearest tents or kitchen.

If dry-earth removal or shallow trenches are impracticable it may be necessary to have *deep trenches.* These should rarely be necessary, as practically the same amount of ground is required for deep as for shallow trenches. Successive deep trenches cannot be made close together. A deep trench (4 feet) has only 2 feet available for excreta, and if the ground is limited shallow trenches may be dug 2 feet deep. If deep trenches can be dug then shallow ones can, except perhaps in sand. Deep trenches take a long time to make and excrement is not readily broken up in them. They are more likely to pollute water supplies and are very difficult to keep free from odour and flies. In fact there are so many disadvantages connected with them that it is hoped the day of the deep trench is over.

Detail of Deep Trenches.—Deep trenches should seat 5 per cent. of troops, and 1 yard per man should be allowed. The greatest care should be taken to prevent the water supply being polluted by them, either directly by filtration or indirectly by surface water in wet weather flowing from the trench or its immediate neighbourhood to a water supply.

(1) (*e*) *Facilities of Approach.*

The camp must have good facilities for approach by foot and by wheeled vehicles, and the approach must be available for different parts of the camp, *i.e.*, the various units.

(1) (*f*) *Facilities for Obtaining Shelter, Food, Fuel and Straw.*

Enquiries should be made from the Army Service Corps officer and the quarter-master as to the arrangements for these necessaries.

(2) *Disposal of Waste Water.*

The nature of the subsoil must be known. The Geological Survey map (Drift series) of the district will be of great assistance, and information may be obtained from the owner of the land or from the local medical officer of health, but it is best to have trial holes dug 4 feet to 5 feet deep in several parts of the camp.

The waste water to be dealt with consists of: The waste ablution water; the waste water from washing cooking utensils; the waste water from washing clothes.

It is difficult to give an estimate of the amount of waste water,

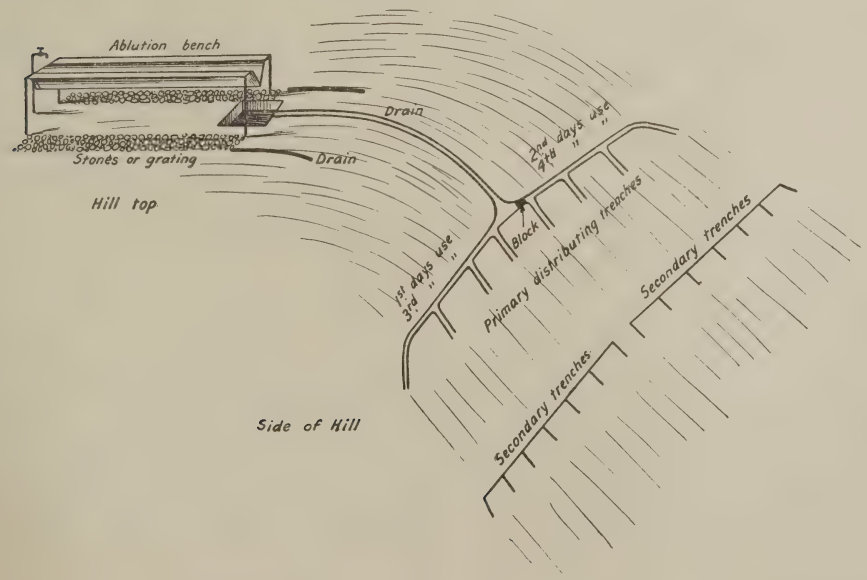
as so much depends on the manner in which water is supplied to the camp, whether bathing sheds are erected, a sail bath is provided, or shower baths are used, &c.

There is always a needless waste in camps, which greatly adds to the difficulties of sanitation and can be largely prevented.

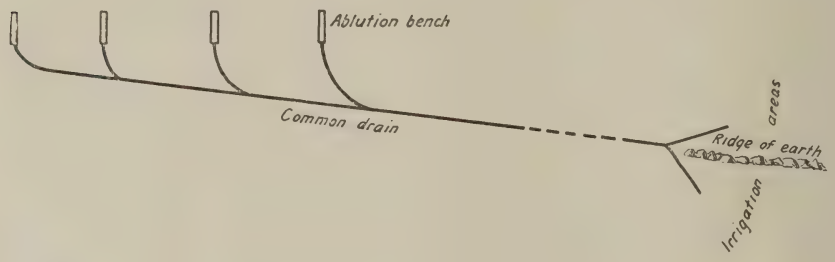
The questions to be considered are: (*a*) Where is the water supply? If the camp is on the watershed the disposal should be by trenches which lead away off the watershed to a safe soakage area. If the camp is not on the watershed, the disposal should be by surface soakage, or soakage from pits. (*b*) What is the subsoil and its depth from the surface. If it is porous and far from an impervious layer, disposal may be carried out by pits. If it is not porous or close to an impervious layer, disposal must be by trenches which lead away to a soakage area at some distance from the camp, and away from the watershed. If a soakage area is not available, lead the trenches into a "common" pit and have the contents pumped out and distributed on roads or elsewhere, by pumping or by conveyance in water-carts.

The best means of disposal in order of merit are: (1) Direct fall on the side of a hill, but great care should be taken that the drinking water is not polluted.

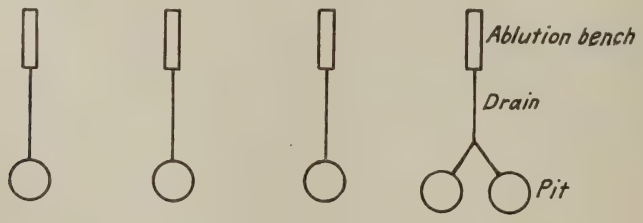
Shallow trenches must be made so as to divert the waste water over a considerable area, and must be so arranged as to irrigate different portions on successive days.



(2) Collection from each ablution bench by a "common" drain, leading to a surface soakage area. The soakage area should be to leeward of the camp and be divided into irrigation areas. The "common" drain should be about 1 foot deep, should run along the natural slope of the land, and if there is to be traffic over it a pipe should be laid in it and covered with brushwood and earth; if a pipe is not available cover the drain with planks or stout branches, brushwood being placed across them and sods of turf on the top.

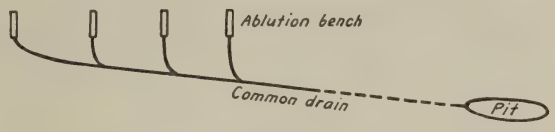


(3) Separate soakage pits for each ablution bench. These are rarely suitable, and only so in very porous soils. Sometimes two pits used on alternate days will be necessary, but if more than two are required it is generally best to adopt method (2) or (4).



(4) Collecting the water from each ablution bench by a "common" drain leading into a "common" pit, and then pumping out the contents. This is the least satisfactory of all the methods, but may be necessary when the ground is not porous and when no surface soakage area is available. The pumping should be done by a steam pump under supervision of the Royal Engineers, with a roster of fatigue parties from the various units to assist. This is much better than having the water pumped from separate pits,

as there is less spillage in camp and only one fatigue party at a time is required. If a steam pump is not available hand pumps will be necessary.



The difficulty is what to do with the water. It should be pumped into water-carts and distributed on roads or waste land. Carts available may be either old wooden service carts which are not used for drinking water, or arrangements may be made with a neighbouring town for the loan of their water-carts. A large tank or a boiler, or even barrels, might be placed in carts for the conveyance of the water; a large tarpaulin might be arranged as a tank in a cart. The times for fatigue parties and pumping should be arranged as is found necessary.

The waste water from washing of cooking utensils and clothes will join the ablution waste water, but the waste water from cooking must be strained first (see Part IV.).

Position of Ablution Benches.—The primary consideration is to place them so that the waste may be carried away easily. There will be a good deal of spilt water about the benches, so they should be placed on a slight slope if possible. If water is to be piped to the camp, place the benches as near existing pipes as possible to save length of piping.

(3) *Position of Cook-houses, Institutes and Messes.*

These should be 100 yards from latrines and urinals. There will be a great deal of waste water to be disposed of from these places, and a place for emptying this water must be close at hand.

(*To be continued*).

United Services Medical Society.

A MEETING of the United Services Medical Society was held at the Royal Army Medical College on March 10th, Colonel D. Wardrop, Commandant of the Royal Army Medical College, being in the chair.

Major W. W. O. Beveridge, D.S.O., R.A.M.C., gave a demonstration of some recent methods of sewage analysis. These comprised the process of Letts and Blake for the estimation of dissolved oxygen in sewage effluents, Adeney's improved form of apparatus for observing the rate of absorption of oxygen by polluted waters, and a method devised by himself for extracting the total gases in sewage.

Major Beveridge prefaced his demonstration by a few remarks on the importance of the fact that as an immediate and essential result of the mixing of a sewage effluent with a tidal water the more or less complete absorption of the oxygen dissolved in the latter takes place. It is therefore necessary in the case of any sewage to know its purity or the degree of putrescible matter present, by ascertaining on the one hand the amount of dissolved oxygen present in the sewage, and on the other by estimating the amount of oxygen it is able to take up, which might be termed its "oxygen appetite." Taking a tidal water composed of equal parts of salt and fresh water, the lecturer pointed out that whereas saturation might be represented by a volume of 6·20 cc. of oxygen per litre, the lowest limit to which it was safe to de-oxygenate such a water was about 3·4 cc. per litre. Below this point there would be danger of destruction to fish. Proceeding then, Major Beveridge demonstrated the process of Letts and Blake for estimating the amount of oxygen dissolved in an effluent. This process depends on the fact that oxygen dissolved in water is absorbed by a ferrous salt plus an alkali (*i.e.*, ferrous hydrate). The amount of oxygen dissolved in an effluent can therefore be estimated by adding a definite quantity of ferrous sulphate and then an excess of ammonia. The oxygen in solution attacks the ferrous hydrate, and the amount of hydrate so attacked is calculated by the amount left unaffected. The latter is estimated by titration against a standard solution of an oxidising agent, *e.g.*, bichromate of potassium. It is advised that the suspended matters

should be removed and estimated separately, as small variations in these might effect the result.

Major Beveridge then demonstrated Adeney's process for the estimation of the amount of oxygen absorbed by a sewage, and the rate of its absorption, in which the partial vacuum caused by the absorption of oxygen in one flask is measured by the rise of fluid in a flask connected thereto by a glass tube. Finally, a method was shown devised by Major Beveridge for the extraction of all the gases in a sewage by a process of boiling under reduced pressure, the gases so extracted being collected and afterwards analysed in a specially modified Orsat gas apparatus.

Mr. N. Bishop Harman then demonstrated a piece of apparatus giving a diaphragm test for binocular vision, founded on the fact that when a man with normal vision in both eyes looks through a hole in a diaphragm, held at some little distance from him, the eyes look crosswise through the opening, the left half of the field being viewed by the right eye and the right half by the left eye. The instrument consists of a flat carrier, 44 cm. long, with a rack at one end to hold the test object cards and a screen at 11 cm. from the rack in which an aperture, either round or square, of an area of 1·7 square cm. is cut. The test objects are of different natures—written type, pictures, or geometrical patterns for children and uneducated people, &c. The uses of the test are to determine the equality or otherwise of the vision, in the two eyes, to determine the presence, absence, or any defect of binocular vision, to exercise the vision in squinting eyes, to detect malingerers feigning monocular blindness, and to demonstrate certain physiological phenomena connected with the perception and suppression of images. The method of working was then demonstrated by Mr. Bishop Harman, and the meeting closed with a vote of thanks to him for his demonstration.

Clinical and other Notes.

CASE OF ACUTE SPORADIC DYSENTERY IN A CHILD ASSOCIATED WITH THE PRESENCE OF *BACILLUS DYSENTERIÆ* (FLEXNER).

By Lieutenant W. E. MARSHALL.

Royal Army Medical Corps.

In this country, apart from asylums and institutions, cases of acute dysentery are comparatively rare, and the following sporadic case in a child is of interest:—

C. W., male, aged 2, child of Corporal W., residing in a block of buildings in Lambeth, previously quite well, was taken ill suddenly on the evening of January 17th, with vomiting and diarrhœa. The stools contained blood and mucus. The diarrhœa continued during the night, and the child was seen medically for the first time on the morning of the 18th. The diarrhœa had then ceased, the temperature was 102° F., there was severe prostration, and the child appeared to be suffering from an acute toxæmia. In the afternoon the temperature rose to 106° F., convulsions set in, the child became comatose, and died at 5 p.m. on January 18th, about twenty-four hours after the onset of the symptoms. There was no *post-mortem* examination.

A sample of the mucus from a stool was taken in a sterile tube and plated directly on MacConkey's bile salt neutral-red lactose-agar plates, and incubated overnight at 37° C. Numerous colonies grew on these plates; all were colourless (non-lactose fermenting), and six of them when tested gave identical reactions. We concluded that the plates were pure cultures of one micro-organism, *e.g.*, a non-motile Gram-negative bacillus giving the following reactions:—

Glucose	Mannite	Cane Sugar	Lactose	Dulcite	Sorbite	Milk			Indol	Gelatine
						1 day	3 days	10 days		
A	A	–	–	–	–	0	0	Alk(s)	+	n.l.

These reactions are identical with those given by Flexner's dysentery bacillus.

The agglutination of this bacillus was then tried with the polyvalent anti-dysentery serum of the Lister Institute. The strains used in the preparation of this serum are *Bacillus dysenteriæ* (Shiga), *B. dysenteriæ* (Kruse), *B. dysenteriæ* (Flexner), strains isolated by Eyre from asylum dysentery, and some strains from cases of infantile diarrhœa in America. Complete agglutination was obtained in two hours up to dilutions of 1 in 2,000, the observations being made microspically at room temperature.

Absorption experiments were then carried out as follows: 1 cc. of a 1 in 20 dilution of the anti-dysentery serum was added to two agar tubes

of the child's bacillus, and a similar quantity to two agar tubes of *B. dysenteriæ* (Flexner). The cultures were emulsified in the serum, incubated for two hours at 37° C., centrifuged and the supernatant fluid pipetted off for agglutination tests. The following results were obtained :—

	Dilution	Child bacillus	*B. dysenteriæ* (Flexner)
Serum—after two hours' contact with culture of child's bacillus	1 in 40	+	+++
	1 in 80	−	+++
	1 in 160	−	+++
	1 in 320	−	+++
	1 in 640	−	+++
Serum—after two hours' contact with culture of *B. dysenteriæ* (Flexner)	1 in 40	+++	(+)
	1 in 80	+	−
	1 in 160	−	−
	1 in 320	−	−
	1 in 640	−	−

+++ = complete agglutination.
\+ = agglutination well marked but not complete.
\+ = slight agglutination.
− = no agglutination.

This bacillus, therefore, though similar in its reactions to the *B. dysenteriæ* of Flexner, did not absorb the agglutinin for that bacillus, whereas the *B. dysenteriæ* of Flexner absorbed most of the agglutinin for the child bacillus.

The father of this child had dysentery in Egypt in 1898, and the possibility that he was a carrier of the *B. dysenteriæ* suggested itself. His stools were plated on two different occasions, but with negative results.

The important points in the case are the very acute nature of the toxæmia, the absence of any history of food poisoning, and the fact that the part of the stool examined was a pure culture of a bacillus, in every way, except in its absorption tests, identical with the *B. dysenteriæ* of Flexner.

A PLEA FOR THE EARLY ADMINISTRATION OF MERCURY IN VENEREAL SORES.

By Lieutenant-Colonel W. WATSON PIKE, D.S.O.
Royal Army Medical Corps.

A year ago I wrote to the Journal under the heading "When Should Mercury be given in Syphilis,"[1] and stated that for some years I had been in the habit of giving it when the appearance of the sore became suspicious or the neck or groin glands became indurated.

I quoted Thalmahn, whose experience pointed to the probability of thus aborting the disease in a large number of cases, and stated my experience had been similar. Since then I have continued this early administration

[1] See Journal of the Royal Army Medical Corps, February, 1908.

of mercury when I had any cases of suspicious venereal sore. My former results have been very fully verified, and I now feel confident that the disease can be, and frequently is, thereby aborted.

Recently I have had three cases, all contracted from the same source; in each case a soft chancre appeared about a week after contact.

In No. 1 this healed up in a few days, but three weeks later a typical hard sore developed. I then put him on mercury; later a typical rash appeared, this was roseolar and slight, and no further symptoms have developed (four months).

In No. 2, as the sore showed no attempt at healing after a week's treatment; I put him on mercury; the sore developed into a typical hard chancre, but this healed up, and no other symptoms have occurred (three months).

In No. 3 (who also had a gonorrhœa) I started mercury about the tenth day. At present (twenty-first day) one side of the sore is showing a little induration; he is still in hospital. I cannot do better than quote a sentence from Sir Jonathan Hutchinson's letter in the *British Medical Journal* of October 17th, 1908, in which he says: "I have long earnestly advocated the earliest possible commencement of mercury, and tried to show the futility of waiting for symptoms. So long ago as 1875,[1] I even suggested that in some cases it might be wise not to wait for the characteristic induration of the primary sore. That it is possible to arrest all further manifestations of the blood disease by giving mercury as soon as the sores show any characteristic features, and before the eruption appears, I have for long insisted, and it has been for the last thirty years my invariable practice to attempt "the abortive treatment of primary syphilis."

In my opinion this should alter our attack on a syphilitic case, and almost make it criminal on our part to withhold the administration of mercury till "secondary symptoms appear." I would even go further, and advise the administration of a short course of mercury in all cases of *single* venereal sore.

KNEE SUPPORT FOR USE DURING OPERATIONS FOR THE REMOVAL OF THE CARTILAGES OF THE KNEE-JOINT.

By Major F. E. GUNTER.
Royal Army Medical Corps.

I have long felt the need of an apparatus which will keep the knee well flexed and rotated during the operation for the removal of the cartilages of the knee-joint. It is usual to employ an assistant for this purpose; but to keep the knee flexed and rotated for any length is extremely tiring, and consequently after a little while the assistant's hands become unsteady and the knee of the patient tends to shake.

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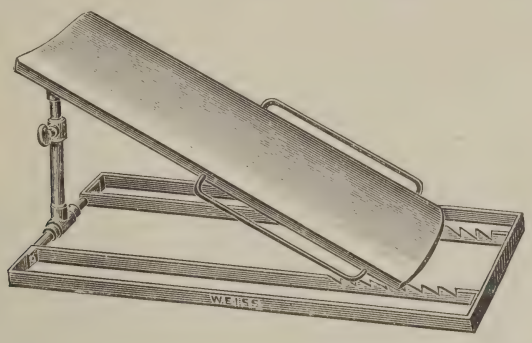
[1] *Lancet*, September 18, 1875.

To obviate this Messrs. Weiss have made for me the support shown in the accompanying illustration. It consists of a movable leg-rest working on a rachet, which enables it to be extended or flexed as required. On either side of the leg-rest are handles, to which the leg is bound by a bandage rotating the knee inwards in case of removal of the external cartilage, and outwards in case of internal. At the back of the apparatus is a movable support for the leg-piece. By means of this support the leg-piece is raised or lowered according to the



length of the thigh, and is fixed to the required height by means of a fixation screw. The support can be lowered till it is in the same plane as the rachet frame, but it cannot be raised beyond a right angle. It has been found that greater play than this is not required, and tends to lessen the stability of the apparatus. To use the apparatus the limb is placed on the splint in the extended position, and is then flexed by adjusting the leg-rest and the vertical support. The leg is rotated inwards or outwards, as required. Before the sutures are inserted in the capsule the fixation bandage is removed and the leg-piece extended so as to relax the capsule. In my own practice I have found the apparatus of the greatest use, and I hope it may be so to others. I may say in conclusion that I have received the greatest assistance from Lieutenant and Quartermaster F. Bruce, R.A.M.C., who made my original model and helped me with many practical suggestions.

A NEW TYPE OF INCINERATOR.

By Lieutenant R. G. F. TATE.
Royal Army Medical Corps.

Through the kindness of Lieutenant-Colonel Beevor, R.A.M.C., the designer of the appliance, I am enabled to describe the construction and working of a new pattern of incinerator, which has been in use in Dalhousie since the beginning of April, 1908. The thoroughness and rapidity with which this incinerator does its work seem far ahead of

anything of the sort yet brought forward, whilst its extreme portability and elasticity of proportions according to the calls on its resources must at once commend it to those who realise the importance of having an effective means of destroying refuse in cantonments and camps.

As will be seen from the accompanying diagrams the incinerator consists of one or more frames of iron, ½ inch thick, the sides of which are L-shaped in section. Across each frame is stretched a floor of strong iron wire netting, strengthened by three bars across the frames. The size of each frame used in this station is 6 feet by 2 feet, as these dimensions are found to be most manageable in practice. In use the frames are supported on six pegs, of the shape shown in the diagram, which raise them about 9 inches off the ground.

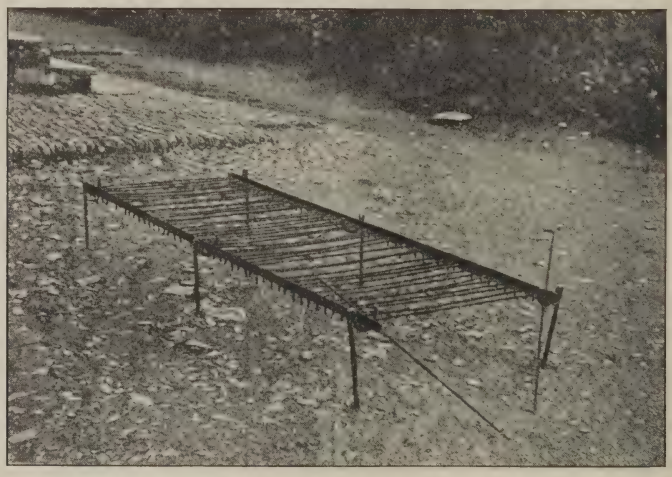


Fig. 1.—Portable incinerator ready for use.

So much for the incinerator; the method of using it involves a comparatively new principle of refuse destruction. Up to this efforts have often been made to boil liquid refuse by the combustion of that of a dry nature. This is open to two great objections: (1) The boiling is often a myth instead of solid fact, which it must be to prove efficient. This has been proved by inoculating sterile agar and gelatine tubes with urine from the receptacles after the so-called boiling. These tubes nearly all gave growths in about thirty-six to forty-eight hours, and hence it is seen that, except under careful supervision, this process may fail. Again, the urine drawn from the incinerator, though perhaps sterile in itself, must undergo putrefactive changes if spilled on the ground about the incinerator, &c, and so may give rise to nuisance if it does not form

a focus for infection proper. (2) One has only to look at the funnels of the incinerator at present in use, often 4 feet or 5 feet from the ground, to see how hard it must be to empty a vessel full of liquid excreta into them without spilling some of the contents. The risk of this is sufficiently obvious.

It occurred to some people that if wet refuse could be properly mixed with that of a dry nature the whole mass could be burned together, and so many types of incinerators were devised for the purpose; but, so far, the refuse would seem to have been generally heaped up on the destructor

FIG. 2.—Portable incinerator packed for transport.

as it arrived, and no genuine effort has been made to mix it up properly before putting it on the fire. As a result, the combustion is often very slow and feeble.

In the present case we go a step farther. A metal trough is provided, varying in capacity according to the needs of the district, and in this the entire refuse, liquid and dry, is mixed thoroughly by a sweeper, told off for the purpose, by stirring it with a rod. The whole is then spread on the frames in a layer of about 3 inches thick, and a fire is lighted underneath. The fire once being started, the destructor can be practically left to itself,

a very little attention being needed beyond adding fresh refuse so as to keep the layer at its proper thickness, and an occasional stir to allow air more free access to the denser portions. The destruction is very thorough, the refuse being entirely reduced to very fine ash, and is little affected by heavy rain, a lean-to roof providing all the protection needed during the rainy season. As to the capabilities of the incinerator, six frames as described, placed side by side and used as one incinerator, easily destroy all the dry and wet refuse of Balun Bazaar (800 inhabitants) in five hours; forty-nine bhaltis from native latrines being one item in the day's work, no fuel but the dry refuse obtained being used.

Two frames are supplied to each infantry battalion, and are found quite sufficient for their purpose. One can easily realise from these

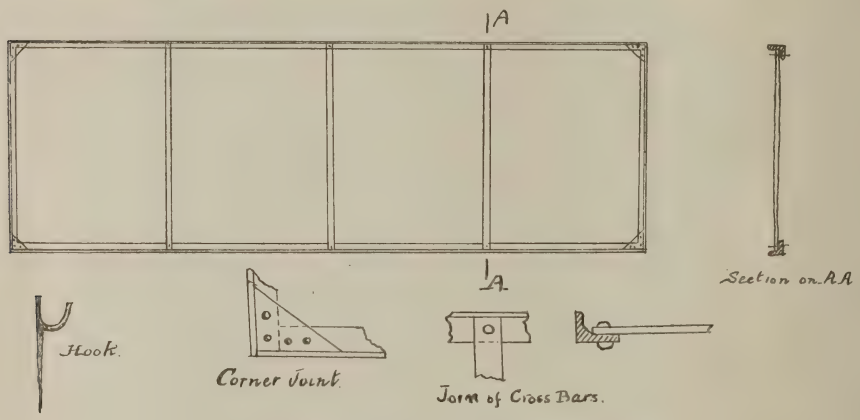


FIG. 3.—Diagram of permanent incinerator frame.

facts the elasticity of the destructor, and its portability can be demonstrated by the fact that a battalion can carry an efficient destructor on manœuvres on the floor of a cart in a space of 6 feet by 2 feet by 4 inches in dimensions. Each frame costs five rupees. The mixing troughs are treated daily with crude oil emulsion to prevent smell arising, and this method so far has proved successful. In some cases metal tubs are used instead of troughs. In a cantonment the value of the apparatus would be great, as small districts could each have their incinerator. The disposal of refuse would be easily and rapidly carried out, and the nuisance of carting to trenching-ground obviated; also the trenching grounds themselves could be largely done away with.

Since writing these notes light iron bars have been substituted for the wire netting when making new frames, and seem to be an improvement, as they form a more rigid structure, and are likely to last longer. They, however, increase the weight of the frames, and raise the cost to twelve

rupees. Also a more portable incinerator for field use has been devised, which consists of two stout side-bars and forty-eight light cross-bars, of which the ends are bent at right angles. The side-bars being supported on hooks as before described, the bent ends of the cross-bars are dropped into holes cut at intervals in them, the result being a firm incinerator frame which can be erected in a couple of minutes, and, when taken to pieces, forms a moderately light load for one man, being 35 lb. in weight.

MEDICAL INSPECTION ROOMS. A PLEA FOR A SUITABLE RECORD BOOK.

By Sergeant H. LADWICK.
Royal Army Medical Corps.

There are few of our medical officers (especially amongst the seniors), who cannot recall one or more instances in which they have been called upon to inspect large numbers of sick at some of the medical inspection rooms. This in itself perhaps is not a difficult task, but should the medical officer have only arrived at the station for duty the previous day, and next morning be confronted with the duty of satisfactorily disposing of some thirty or forty sick (?), then his task is fraught with innumerable difficulties, having to discriminate between the genuine case and the schemer; the former can generally be determined at once, but the latter, with his whining manner and phantom ailments, calls forth all the tactful resources of the medical officer. Enquiry may be made from the Royal Army Medical Corps staff whether anything is known of the man, and should the answer be in the negative, then the medical officer is "no forrader," whereas if some permanent record or original data were at hand, he would be considerably aided thereby in disposing of such cases, whilst much valuable time would be saved every morning.

For example, we may take a station where the average number reporting sick daily is, say, thirty, and a fresh medical officer has just taken over; the present system of statistical records does not help him a bit in discriminating between the man who is *always* reporting sick and the genuine case. The admission and discharge book kept for "treatment in barracks" only shows the man who is "*attending*," not the man who reported sick yesterday and was marked medicine and duty, and who again reports sick this morning; reference to the duplicate sick report (which is not always available) is a tedious process, and in any case does not give the desired information.

With a view to overcoming the difficulties set forth, and also to establish a systematic method of recording particulars of all men who report sick, the adoption of a book (any of the larger Army books will do) ruled and headed as per specimen herewith, will be found to answer all

Book No.	Date	Corps	Company	Regt. No.	Rank	Name	Years of			Disease	Medicine and duty	Hospital	Light duty	Excused duty	Detained	Temperature		If inoculated	If on syphilis register	Remarks
							Age	Service	Service in country							M.	E.			
1	1/1/08	2nd Border	F	1671	Pte.	A.	24	3	2	Wound knee		Yes								Accident football yesterday.
2	,,	,,	G	1983	,,	B.	23	3	2	Constipation	Yes									
3	,,	,,	H	1742	Corpl.	C.	24	5	3	Sprain ankle				Yes						
4	,,	,,	A	1247	Serjt.	D.	26	7	2	Tonsillitis			Yes			99·2	98·8		Yes	Pain throat; gargle; temperature evening.
5	,,	Det. A.O.C.	24	982	Pte.	E.	22	3	1	Conjunctivitis					Yes					Eye lotion; see Treatment book.
6	,,	,,	,,	829	,,	F.	20	2	1	I. G. toenail				Yes						
7	,,	3rd Hussars	G	1680	,,	G.	20	2	1	Colic	Yes					N.				
8	,,	,,	,,	1508	,,	H.	21	3	2	Contusion eye	Yes									Accident hockey yesterday.
9	,,	1st K.O.Y.L.I.	B	4206	,,	I.	22	3	2	Bron. cat.	Yes					N.	99·0			Return 5 p.m. for temperature.
10	,,	,,	D	4161	Corpl.	J.	22	3	2	Sore throat					Yes	99·8	100·0			Inhalations and mixture; see Treatment Book.
11	,,	,,	C	4301	Pte.	K.	24	4	3	Wound finger	Yes									
12	,,	2nd Hants	F	1612	,,	L.	28	8	4	N. Y. D.		Yes				102·0		Yes		States felt ill for past six days.
13	,,	9th Lancers	H	1415	,,	M.	26	7	2	Fracture rib		Yes								Kick from horse this morning.
14	,,	,,	B	2272	Serjt.	N.	27	9	3	Tooth extracted	Yes									
15	,,	,,	D	1684	Pte.	O.	20	2	1	Scabies										Kit, &c., sent to hospital; disinfection carried out.
16	,,	,,	C	1411	,,	P.	20	2	1	N. A. D.	Yes									Informed C.O.; third time reported sick in ten days.
17	,,	2nd R. Fus.	E	1908	,,	Q.	21	3	2	Caries dentine	Yes									
18	,,	,,	G	1900	,,	R.	23	5	3	Conv. enteric										Discharged hospital yester-
19	,,	,,	H	1819	,,	S.	27	7	3	Earache	Yes			Yes						Syringe ear. [day.
20	,,	,,	F	1822	Serjt.	T.	24	4	2	Caries dentine	Yes									Note to dentist.
21	2/1/08																			
22																				
23																				
24																				
25																				
26																				
27																				

requirements at medical inspection rooms or non-dieted hospitals: additional headings could be made if necessary. In practice this book has proved most useful, forming as it does a continuous record of all men reporting sick, and shows the disposal of the same, irrespective of the time they were under treatment.

It may be argued that a lot of clerical labour is involved by its use; from experience, here let me say, such labour is amply repaid, for the book, being a complete record, enables you to answer at once all questions that crop up from time to time regarding the dates on which a certain man reported sick, and how he was disposed of, particulars respecting men who report sick with wounds or injuries not sufficiently serious in themselves to necessitate the case being sent to hospital, or even to receive extended "treatment in barracks," but to which a certain importance is attached should it subsequently be found expedient to assemble a court of enquiry, &c. The names of the loafers will appear with amazing frequency in the record book. You can tell at a glance the average number of men *reporting sick* daily for any particular week, month, or year, also the *exact number* on any particular day, week, &c., whereas the official admission and discharge book does not give these particulars. At the close of each month the various columns are totalled and carried to the end of the book, headed "monthly summary"; the total of all the columns should agree with the total number of cases reported sick during the month; not actually the number of individuals, but the number of attendances. On the 1st of each month the book numbers start afresh.

Monthly Summary.

Month	Medicine and duty	Hospital	Light duty	Excused duty	Detained	Total	Remarks
January ..	204	48	22	36	47	357	
February ..							
March ..							
April ..							
May							
June ..							
July							
August ..							
September ..							
October ..							
November ..							
December ..							
Total ..							

A brief explanation as to daily procedure in keeping such a book may assist members of the Corps to introduce at other stations a system which has proved a success at Pretoria for the past two years. By arrangement, the sick arrive at the inspection room some fifteen minutes before

the medical officer—this gives the orderlies time to remove old dressings, cleanse wounds, take temperatures, &c., as may be necessary; meanwhile, assuming the book is already ruled out, the names of the morning sick are copied into it from the sick reports, and the temperatures entered up —those of the previous evening being entered at 5 p.m. on that day. The book is now placed on the medical officer's table, and all is ready for his inspection—it is only necessary for him to mark one sick report, the duplicate entry being made in the record book, except when a man is admitted to hospital, in which case the duplicate sick report is also marked and sent to hospital with the patient. A roll of men who have been inoculated or who are on the syphilis register is kept in the office, and such entry recorded in the book when necessary. The column "detained" would of course only be used at inspection rooms where beds are provided. The names of any men who have been under treatment for two consecutive days (or longer) are carried forward to the official A. and D. book, which is sent to the military hospital weekly, and also at the end of each month, so that the particulars may be extracted therefrom for inclusion in the monthly return "treatment in barracks," rendered by the Senior Medical Officer.

A CASE OF TAPEWORM CAUSING ACUTE GASTRITIS.

By Lieutenant W. G. AVISS.
Royal Army Medical Corps.

Colour-Serjeant B., returned from South Africa in September, 1902, feeling fit and well. He had suffered from slight dysentery there. He was quite well till early in 1905, when, to use his own words, "Pains in my inside began to trouble me when route marching or on brigade parades. The pains commenced on the right side of the bowels and gradually moved to the bottom of my stomach. They lasted from one and a half to two hours and were bearable. As time went on they became more frequent, coming on even when I had not exerted myself. In August, 1907, the same pain started on my right side, and after about two hours suddenly gripped me at the bottom of my stomach, which compelled me to collapse. I had to be carried to hospital. The pain was like cramp and lasted for ten hours."

I saw and treated the man on this occasion. A fat and flabby man, he had symptoms and signs which I thought were accounted for by chronic constipation, aggravated by a "snack," consisting of one haddock and 4 lb. of plums. He got over the pain, but still had abdominal discomfort. I discharged him in eleven days, when he had regular matutinal motions and a clean tongue.

He came sick again (having consumed a roast ox-heart at breakfast) on May 3rd, 1908, with great epigastric pain, vomiting, diarrhœa, and

filthy tongue; temperature 102° F. As his condition remained the same for five days he was put on plain water, and nothing else, as the case was regarded as acute gastritis (he habitually ate too much). The pain subsided and the temperature fell to normal in three days, but he still had a foul tongue and abdominal discomfort. I gave him a purgative and 90 minims of liquid extract of male fern, with 3 grains of santonin, which resulted in the expulsion of a 14-foot *Tænia solium*. His tongue now cleared rapidly, his eye brightened, his desire for food became normal, and he was happy and vigorous. He was again treated for a worm, but without success. Now he leaves hospital feeling better than he has done for the past three years. The conclusions drawn from this case are, that a worm may probably cause either constipation or acute gastritis and possibly a diagnosis of "fulminating appendicitis."

A CASE OF INSUSCEPTIBILITY TO COCAINE.

By Major W. T. MOULD.
Royal Army Medical Corps.

Private K. was admitted into the Station Hospital, Mount Abu, on August 30th, with both great toenails ingrowing. After the toes had been prepared for operation, I injected a solution of 5 per cent. cocaine hydrochloride at the base of the nail and on each side; after waiting the usual time I tested the skin for anæsthesia and found it was quite sensitive. Two minutes later I repeated the injection and found that this also had no effect. The solution had been prepared three days previously and was then active, and it was successfully used in other cases later. After the second series of injections had failed the patient told me that some weeks previously a medical officer at Nasirabad had used cocaine in the same way, proposing to remove the nail, but had failed to make the skin insensitive, so had not removed the nail. The man suggested as the reason of the failure that he had had both feet frostbitten in snow before enlisting.

The nails were subsequently removed, the skin being frozen with ethyl chloride. The sensation of the skin was normal to all tests.

Lecture.

HISTORICAL SKETCH OF THE DISCOVERY OF THE CIRCULATION.

By Surgeon-Captain Robert SAMUT.
1st King's Own Malta Regiment.

Few subjects have passed through so many phases in their evolution as that of the circulation of the blood and the controversy about its discovery has been so keen that to this day the claims of Harvey are disputed. Yet it was William Harvey who, unbiased by the teaching of the ancients, first placed the doctrine of the circulation of the blood on those firm foundations which his enemies and detractors have failed to shake, and which more recent methods and careful experiments have helped to consolidate.

In the middle of the sixteenth century we find that the Galenical conception of the circulation was still generally accepted. None then ventured to deny that the left side of the heart and the arteries contained blood mixed with air, and that the septum of the heart was pierced with innumerable but invisible pores, through which the blood returning from the liver found its way from the right to the left ventricle. This doctrine, which, like the rest of Galen's teaching, was upheld as infallible, was not questioned till 1543, when Vesalius demonstrated the impermeability of the septum, and ten years later Michael Reves or Servete, the Spanish philosopher, completely overthrew the oracle by asserting that the blood is conveyed by an admirable contrivance from the right ventricle of the heart through the substance of the lungs, a theory which cost him his life, for he was burnt as a heretic at Geneva a few months after the publication of his "Christianismi Restitutio."

Though taught by Servete, a complete account of the pulmonary circulation was first published in Venice in 1559 by Realdus Columbus: "For the blood is carried to the lungs by the arterial vein, and here becomes lighter; then, along with the air, it is carried by the arterial vein to the left ventricle of the heart." Here again the truth about the circulation was obscured by the same error, since, in the words of Professor W. Osler, the heart was looked upon as "a lump which is furnished with oil by the blood, and with air from the lungs." Nor can it be said that the problem was solved by Andreas Cæsalpinus of Arezzo, who, in 1571, discovered that arteries beat and that veins do not, that the blood reaches the heart by the veins and leaves it by the arteries, and that ligature of a vein causes it to collapse between the ligature and the heart and to swell beyond the ligature (figure from "De Motu Cordis").

With Aristotle he maintained that the blood flowed like the tides of Euripus, backwards and forwards in the same channel, viz., from the arteries into the veins during sleep and back into the arteries during the hours of activity. Upon him the honours of discovery are conferred by the Italian School (Luciani-Fisiologia dell'uomo, chap. vi., pp. 138-147). Nevertheless, ten years later Fabricius ab Aquapendente maintained that the blood flowed from the heart to the extremities even in the veins; this, then, is incontestable proof of the ignorance of the true facts connected with the circulation at the beginning of the seventeenth century. Professor Osler is, therefore, correct in saying that Cæsalpinus had Hippocratic glimmerings of the greater circulation, but was pervaded with the general spirit of the time and saw darkly through Galenical glasses. It has been rightly said that the title of discoverer is due to him alone who can prove his theory, and in the matter of the circulation of the blood this was reserved for the pupil of Fabricius. Nothing but a loose collection of facts, the outcome of the earnest researches of the Italian masters, true pioneers of this discovery, had accumulated when Harvey graduated at Padua in 1602. With these at his command, and with the acute discernment of his great mind, he was able to give to the world the doctrine which must ever stand as one of the great turning-points in the development of human knowledge.

William Harvey delivered his second Lumleian lecture on the circulation of the blood at the Physicians' College, London, on April 17th, 1616. Twelve years later he published his work "De Motu Cordis et Sanguinis in Animalibus," and his absolute conviction that his conception of the circulation was original is made evident in the eighth chapter, in the following passage: "The things that remain to be said, though well worth considering, are so new and strange that I not only fear harm from the envy of certain men, but am afraid that I make all men my enemies; for custom or a doctrine, having once taken deep root, like second nature, hold their ground among all men, and reverence for antiquity binds them down. Be that as it may, the die is now cast, my hope is in the love of truth and in the sincerity of learned minds."

No fact of any consequence has been added to the subject since the publication of Harvey's work, nor can a single word of his great enunciation be altered: "that the blood flows into all the members of the body through the arteries and outflows through the veins; that the arteries are the vessels carrying blood from the heart, and the veins are the vessels and the ways for the blood's return to the heart, that the blood in the members and extremities, either by direct anastomosis, or indirectly through the pores of the flesh, or in both ways, flows into the veins from the arteries just as in the thorax it floweth from the veins into the heart and arteries; hence it is evident that it moves in a circle, namely, from the centre to the extremities, and from these again to the centre."

Thus, whilst others groped in the uncertain light of their knowledge in search of the true course of the blood, the genius of Harvey shed such "a flood of light" on the subject that the great truth was at length revealed in all its beauty, so that none can ever question the justice of Albert v. Haller's words: "Circuitus sanguinis Harvei famam immortalem fecit" ("Elementa Physiologiæ corporis humani," 1757).

Reviews.

A System of Diet and Dietetics. Edited by G. A. Sutherland, M.D., F.R.C.P. London: Henry Frowde and Hodder and Stoughton, 1908. Pp. 893. Price 30s. net.

This volume, of over 900 pages, is one of the latest "Oxford Medical Publications," in which all that has been attempted, as the Editor says, "is to set down the principles and practice of men who have had special experience of the subjects on which they write." No less than nineteen authors, all more or less well-known, have collaborated in the production of the work, which consists of twenty-eight chapters. The treatment of the subject is therefore encyclopædic, and "it may have followed that a certain clashing of views is to be found, but this may be taken as reflecting the divergence of opinion which exists in the profession on the subject of diet. Contributors were asked to give their own views and experiences, rather than to make a collection of all the views of different authorities." The result is undoubtedly an authoritative work, and every chapter bears the impress of first-hand knowledge and personal experience. Some chapters will, perhaps, carry greater weight than others with the ordinary reader or practitioner, but this is inevitable in a cyclopædic compendium.

Sir Lauder Brunton, in the introductory chapter on General Principles, thinks "one may safely say that more than one half of the inhabitants of this country require a certain amount of aid to the action of the bowels." We quote this in order to afford satisfaction and cause for thankfulness to the smaller moiety in these islands, who, either through their active habits, or dietetic tastes, or by innate peristaltic virtue, perform their natural functions with regularity and precision without assistance, and therefore need not habitually partake of "seeds, husks or vegetable fibres," or even sulphates or purgative resins. Chittenden's dictum is approved of, that "the best dietary for a healthy man is a mixed diet and not too much of it." Sir Lauder Brunton mentions the powerful effect of strawberries in quickening the flow of lymph from the blood into the lymphatic spaces. In one case a single strawberry produced such a swelling of the eyelids as almost to blind the patient. In an obscure case resembling pernicious anæmia, drugs seemed to do little good, but many strawberries eaten all through the day produced very marked benefit.

Dr. Harry Campbell's chapter on the Evolution of Man's Diet is very interesting. The first great advance by evolving man was when he began to hunt and fish; the second, when he began to grind, macerate,

and above all, to cook his vegetable food; the third, when he began to cultivate the plants and breed the animals he had come to value; the last period "began, we may conjecture, some 30,000 years ago." Dr. Campbell traces the development during this last period, noting that "there has been a progressive abandonment of raw vegetable food, the power of digesting which, after steadily waning during the previous diet epochs, has consequently still further declined"; by cooking the food becomes more easily masticated, more easily swallowed—"it slides down into the stomach with pernicious ease and affords little or no exercise for jaws or salivary glands. From the point of view of dietetics the present age may, in this country at least, be characterised as the 'age of pap'" (p. 53). Moreover, the food substances that make up a modern dietary are highly nutritious, *i.e.*, concentrated, whence result three consequences: (*a*) constipation; (*b*) over-eating, because eating is so easy; (*c*) some extent of the alimentary tube, notably of the lower bowel, is becoming redundant. Then as to the rearing of infants, in the earlier ages no infant could survive unless the mother suckled it; consequently all mothers with defective nursing capacity were prevented leaving offspring who might inherit their defect, *i.e.*, they were racially eliminated. Nowadays, with the prevalence of artificial infant feeding, it appears as if the mammary function will undergo a progressive atrophy—either from incapacity or disinclination; and "side by side with this maternal devolution we may look for a corresponding evolution to take place, by natural selection, in the digestive organs of the young human," so that he will be able to digest cows' milk with ease; or some enterprising person may breed an animal that will produce approximately human milk; when we may suppose all parties will be satisfied, except the purveyor of patent foods. Dr. Campbell is not one of those who believe that meat-eating is to be condemned. He is by no means a vegetarian; indeed "as a matter of experience we can, on the whole, do more good by curtailing saccharides than by cutting down animal food, and this even in such diseases as gout and megrim" (p. 64); and again, "care should be taken to guard against an excess of sugar" (p. 67). But what is excess? The conclusion of the whole matter is that "it is not possible to attempt the construction of a stereotyped dietary for man; nor if it were would it be advisable, since his dietetic adaptability is an advantage to the race."

The chapters on the Physiology of Digestion, Absorption and Nutrition, including a *résumé* of experimental researches, by Dr. E. I. Spriggs, give a condensed but intelligible and interesting account of this difficult subject. Dr. Spriggs does not agree with the recent advocacy of a "low protein" dietary; he considers that "it is always desirable to supply protein in the diet in excess of the actual requirements in order that there may be plenty of choice" (p. 98). He considers Chittenden's dictum—"that the universal choice of a liberal protein diet by man cannot be taken as evidence that that foodstuff is beneficial in quantity, any more than the very general taste for alcohol proves it to be a desirable foodstuff" (p. 144)—depends on a false analogy, because "alcohol, though physiologically capable of acting as a foodstuff, is not at all comparable to either protein, carbohydrates, or fat. Before it can be classed with them it must be shown that a man or animal can exist for long periods of time in health, while drawing a large proportion of his energy needs, say a third, from alcohol. This has been shown for protein innumerable

times." There seems to be here some confusion of thought. Rightly or wrongly the bulk of mankind like alcohol, when they can get it; rightly or wrongly they also like a high protein dietary, when they can get it. If an argument can be drawn from the one universal preference, surely a similar argument can be drawn from the other; whether alcohol is strictly comparable with protein as a food substance is not *ad rem*—the point is universality of preference. The experiments on animals adverse to the low protein theory are mentioned (Rosenheim, Munk, Jägerroos); but the later researches on dogs, by Chittenden himself, which were favourable, and his criticisms on the earlier bad results of other experimenters (the dogs being kept in strict confinement, the dietary being very monotonous and deterioration consequently setting in) are not mentioned. (See Chittenden's "Nutrition of Man," 1907, and this Journal, vol. x., 647). The general conclusion is, however, well stated in these words: "We may sum up the relation of protein to activity by saying that the bulk of the calorie value required for muscular work should be supplied by carbohydrate or fat, but that it is an advantage to also increase the protein in the food, and that a diet containing a fair amount of protein is likely to be favourable to an energetic existence" (p. 148). On p. 103 it is stated positively "that sugar can be formed from protein"; recent research is certainly to that effect, but it might, perhaps, be advisable to mention that no less an authority than Pflüger does not admit this to be the case (van Noorden's "Metabolism and Practical Medicine," i., 88). The present position of the whole question of food metabolism is excellently stated thus: "It is evident that our knowledge of the fate of foodstuffs in the tissues is very imperfect. Nevertheless, great strides have been made in the last ten years in this study of the intermediate metabolism. These researches are of vital importance to the science of dietetics. Only as we understand the exact uses to which foods are put can we expect to adapt the diet wisely to all the varied needs of the individual and to guide public opinion, both in respect to food and to general hygiene, along such paths as shall lead to the perfect development of the body and of the mind" (p. 104).

An extended table of the Composition of Food Materials is given on pp. 115-120, derived from Atwater and Bryant's Bulletin No. 28 of the United States Department of Agriculture; this will be most useful, as the original Bulletin is not very generally accessible.

Dr. Spriggs lays down 40 calories per kilogramme body-weight as the average fuel value required daily by adults, 35 for a person leading a sedentary life, and 25 for an individual resting entirely in bed. Although the last figure is probably correct, it is doubtful if, under the ordinary circumstances of living, there is any proportion so close as is here stated between the body-weight and the food required. A big man needs more than a small man, but a man of 12 stone does not usually take, or require, anything like half as much again as a man of $8\frac{1}{2}$ stone; indeed, a few pages later on it is mentioned that stout people require less food per pound of body-weight, as they suffer a smaller loss of heat from the body surface than thin folk. With regard to the effect of climate on the amount of food required, the difference amongst civilised races is much less than might be expected; and Rübner's observation is appositely quoted, that "we all live in a temperature of about 90° F., which is that of the air between the skin and the clothes." Less than a page,

however, is devoted to the subject in this chapter, which is inadequate. The author adopts Atwater's standard diets (p. 154), viz., 100 grammes protein, and 2,700 calories for a man doing no muscular work, 125 grammes and 3,500 calories for moderate, and 150 grammes and 4,500 calories for hard muscular work; although this is not quite consistent with the "Standard for a man of 11 stone of moderate activity," given on p. 151, which contains no more than 100 grammes protein, with 100 grammes fat, and 360 grammes carbohydrates, yielding 2,820 Calories.

In Dr. Edmund Cautley's chapter on Diet Cures and Special Diets, we note that "the purin-free diet may be tried for gout and gouty conditions, renal disease, headaches and neuralgias, bilious attacks, recurrent vomiting, and chronic affections of all kinds. There is no proof that it is of any decided value, either in modifying or curing these constitutional states. Practically, it will be found that the benefit derived from this diet is mainly dependent on its simplicity, on efficient mastication, on the limitation of intestinal putrefaction, and on the prevention of over-eating, which the return to a simple and limited diet involves" (p. 187). Descriptions are given of various "cures" and "diets," the attitude adopted being eminently rational and practical.

Dr. Cautley's other chapter on Patent and Proprietary Foods is also extremely useful and practical, tables being supplied showing the composition of a large number (though the analyses are in many cases "those given by the makers"). It is rather difficult to tell whether the writer really approves of condensed milk as an infants' food or the reverse (compare p. 221 and p. 222). On the whole he appears to allow that it has considerable value, with which opinion we entirely agree. More information might have been given with regard to dried milk, of which there are now several preparations obtainable, far more satisfactory than any that could be got a few years ago. Dr. Cautley considers Benger's Food to be "the most valuable proprietary food on the market" (p. 226).

The chapter on Alcohol in Health and Disease by Dr. Harry Campbell is well reasoned from the standpoint adopted. The author lays down that the degeneration caused by alcohol is not inherited; that civilised peoples tend to become racially resistent to alcohol; that it is impossible to banish alcohol from the world, or effectually protect the born drinker from the poison which is his doom; and that with the medical profession lies the responsibility of preventing, as far as in them lies, the propagation of congenital inebriates. "While using every legitimate means to protect this unhappy class from the misery and degradation which drunkenness entails, [the medical man] would seek to make them realise their responsibility to the race, and abstain from propagating their kind." It is admitted that this is a counsel of perfection. It might be said that, from a practical point of view, such a course would be hopeless and useless. *Nulla Venus sine Baccho* is not literally true, but has a considerable modicum of truth; if a man, being yet sober, has not strength of mind to abstain from drink, is he likely, when he is drunk, to be penetrated with a philosophical regard for the health of posterity and have any desire, let alone strength of mind, to abstain from the sexual act? The appeal from Philip drunk to Philip sober has some force, but what is the good of an appeal to Philip drunk?

With regard to the influence, if any, of moderate alcoholic consumption on the duration of life, it is stated (p. 272) that the mortality of

total abstainers has been found to be considerably below that of temperate drinkers. Reference might here have been made to the important, but not widely known, paper by Mr. R. M. Moore, read before the Institute of Actuaries in 1903, in which he showed that the mortality rate of total abstainers, between the ages 20 and 60, was not more than 70; and between the ages 30 to 50, less than 60; compared with the mortality figure of moderate drinking non-abstainers, taken as 100. The figures were based on sixty years' experience of the United Kingdom Temperance and General Provident Institution, and were most carefully scrutinised and criticised. (The main points were summarised by Sir Thomas Whittaker in the *Contemporary Review*, March, 1904.) When Dr. Campbell writes (p. 274) that "while the medical man should fight with all his might against the abuse of alcohol, he should. . . look with a kindly eye on the moderate drinker," though we agree with his point of view, we very much fear that his authority will be quoted with the emphasis on the "drinker," rather than on the "moderate." In India and most tropical countries there is now little excess in spirit drinking, or indeed in any kind of alcoholic consumption; the statement "that a large number of Englishmen in India daily consume, in repeated nips, three quarters of a bottle of whisky" (p. 276), though qualified by the words "we have been informed," is certainly likely to give rise to misconception. Amongst the military population such a practice is almost unknown, and amongst civilians it is certainly very unusual. We feel bound to criticise the author in some small points, but on the whole we heartily agree with his common-sense and temperate handling of the question of alcoholic consumption in health and disease.

The subject of Dieting in Various Diseases occupies nearly half the volume, and is well treated by various authors (C. B. Ker, N. D. Bardswell, J. E. Chapman, A. P. Luff, J. Rose Bradford, H. P. Hawkins, W. Hale White, W. J. Hadley, J. M. Cowan, T. Colcott Fox, and the Editor). We have only space for a few remarks on the later chapters. We are glad to see that the slight diminution in digestibility and nutritive value of boiled, as compared with fresh, milk, is not allowed to outweigh the great advantage of protection of children from infectious disease that is afforded by boiling. "On the whole it may be said that the boiling of milk, especially in hot weather, is a great safeguard, and does not injuriously affect the nutritive properties of the food" (p. 757). Scurvy may, of course, develop if the milk is all boiled, or only certain patent foods used; but this can be guarded against by appropriate means (raw meat, fruit juice, &c.). In some cases, as Dr. Colman has pointed out, improvement is not to be looked for unless *all* preserved (patent) foods are omitted from the diet; the explanation may be found in the toxic theory of scurvy. Nansen relates "that scurvy did not arise in his Arctic expedition as long as the tinned provisions were wholesome, but the preservation was imperfect, and scurvy broke out. Now tinned foods are largely associated with the occurrence of infantile scurvy, and although the food may be sound when the tin is opened, it is very liable to decompose after being exposed to the air" (p. 850). As to pasteurised *versus* sterilised milk, Dr. Sutherland's opinion is that "it is questionable whether anything is really gained by this process which cannot be more simply secured by boiling the milk" (p. 771); but surely the heat-coagulable proteid matter is retained in the one case and lost in the

other: besides which, the alteration of taste in boiled milk does in many cases cause difficulty in getting children to take it (or their mothers or nurses to give it them).

The chapter on Diet in the Diseases of Hot Climates is not quite so satisfying as one would expect from its distinguished authorship (Manson and Daniels), although of course nearly everything of importance is mentioned. It is not actually confined to diet in disease, but perhaps fuller consideration might have been given to climatic factors in regulating the dietary of the healthy resident in the Tropics. A timely warning is given in regard to tinned foods, but more detailed instructions might have been given as to detection of unwholesome or undesirable tins, as well as those that are actually "blown." It is stated that "the contents of tins showing two soldered points should not be used for food;" this is certainly the rule, but there is at least one preserving process in which two solder holes are properly present. No advice is given as to the relative harmlessness or hurtfulness of the various tinned articles so commonly used in India, &c. It would have been well to have warned the unsuspecting against such dangerous articles as tinned "fresh herrings," as compared with the almost invariable wholesomeness of tinned salmon, when in good condition. In regard to Malta fever, it should have been mentioned that it is wiser, in places affected by this disease, to use only tinned milk, and to abstain entirely from fresh milk, whether nominally from the cow or from the goat, whether said to be boiled or not.

This work is a very valuable one for all classes of practitioners. We regret that we cannot say that it holds "infinite riches in a little room," for it measures 10 by 7 by 2½ inches, and is therefore not well adapted for the wants of the travelling medical officer. As a set-off to this, the printing is admirable, indeed luxurious, as in all the Oxford medical publications. We note a few misprints: "philogeny" for "phylogeny" (p. 33), and "philogenesis" (p. 61); "catalyze" and "hydrolyze" do not read well with "catalysis" and "hydrolysis." Is this the Oxford way? "Entendance" (p. 137); "signalled" for "singled" (p. 254); "Mainhot" for "Manihot" (p. 856). A. M. D.

The Principles of Hygiene as applied to Tropical and Sub-tropical Climates. By W. J. R. Simpson, M.D., Professor of Hygiene, King's College, London. London: J. Bale, Sons and Danielsson, 1908. Pp. 386. Price 15s. net.

This volume represents the subject-matter of Dr. Simpson's lectures at the London School of Tropical Medicine. Probably few men, from their experiences, are better qualified to speak authoritatively upon the sanitary problems to be met with in tropical countries, and we have here an eminently reliable summary of sanitary practice suitable for tropical conditions. The book is very readable and not overloaded with detail, but we think the author will much improve its general utility if he remodelled and extended the chapter on the communicable diseases. Fuller details as to the natural history of parasites and the insects which are now recognised to play a great part in the incidence of disease in hot countries would immensely enhance the value of the book. In other respects, the lectures afford sound information, and more particularly do we like the chapters on food and dieting in the Tropics, or conservancy

and disposal of sewage, on the hygiene of streets and houses, and that on the influence of climate on the individual. The section on the domestic purification of water is hardly up-to-date, while that on the examination of water is not likely to be practically helpful to the ordinary reader. The book gives us the impression of having been published hastily, and many of the illustrations seem unsuitable and might well be omitted in a later edition. In spite of these criticisms, the volume will meet a want, as we know of no other attempt to discuss the sanitary problems of tropical life, and we cordially commend it for study by all engaged in sanitary effort in the Tropics. R. H. F.

THIRD REPORT OF THE WELLCOME RESEARCH LABORATORIES AT THE GORDON MEMORIAL COLLEGE, KHARTOUM. By Andrew Balfour, M.D., B.Sc., F.R.C.P.Edin., D.P.H.Camb., Director. Baillière, Tindall and Cox, 1908. Price £1 1s.

REVIEW OF SOME OF THE RECENT ADVANCES IN TROPICAL MEDICINE, HYGIENE, AND TROPICAL VETERINARY SCIENCE. Supplement to the above. By Andrew Balfour M.D., &c., and R. G. Archibald, M.B., R.A.M.C., attached Egyptian Army, Pathologist and Assistant Bacteriologist. Baillière, Tindall and Cox, 1908. Price 10s. 6d.

The Wellcome Research Laboratories, Khartoum, are prolific in producing good work, the results of which are embodied in a series of elaborate and beautifully illustrated reports.

The first report, dated 1904, dealt with the biting flies of the Sudan —insects injurious to crops—human and veterinary pathological observations, and the chemical analysis of native drugs and soils.

In the second, published in 1906, fresh researches on these and kindred subjects are recorded, new protozoa described, and anthropological notes added.

The third has now appeared. It contains an abundance of original matter. There is an excellent monograph on spirochetosis in birds by the able Director, Dr. A. Balfour, who gives a complete account of the subject. He has discovered an intra-corpusular "after-phase" of the spirochæte. A coloured plate depicts these forms which appear as chromatin bodies in the red blood corpuscles, not unlike those observed by Leishman in the ova of ticks infected with *Spirochæte duttonii*. The Director also contributes papers on the "Hæmogregarine of the Jerboa," on a new hæmogregarine, which he discovered in the blood of a rare snake, *Rhamphiophis rubropunctatus*, on piroplasmosis in the Anglo-Egyptian Sudan, on trypanosomiasis in animals, and on a halteridium in the Khartoum toad. He gives a history of sanitation in Khartoum, its present state, and many useful practical notes with which are incorporated a description of the construction of dwelling-houses suitable for the Tropics, with plans by W. H. McLean, A.C.T.C. Assoc.M.Inst.C.E., Lecturer on Civil Engineering, Gordon College.

An extract of Captain H. Ensor's Report to the Sudan Sleeping Sickness Commission is inserted. This officer finds that *Glossina palpalis* exists almost exclusively within 20 yards of open water. It must be sheltered by the shade of large trees. Thick scrub and long grass do not harbour it; nor is it observed in papyrus swamps; it bites by day. Captain R. G. Archibald, R.A.M.C., records that atoxyl, atoxyl and

mercury, and tartar emetic all alike gave unsuccessful results when administered to several hundred natives infected with trypanosomes. He states that gland puncture is not such a reliable method of diagnosis as the examination of the surface layer of 1 cc. of blood mixed with 1 per cent. citrate solution and centrifugalised for fifteen minutes.

In an article on kala-azar in the Anglo-Egyptian Sudan, Major S. L. Cummins, R.A.M.C., gives abstracts of seven cases which all with one exception arose in the vicinity of the Abyssinian frontier. One of the victims was the late Dr. MacTier Pirrie, the Anthropologist of the Gordon College. He unhappily succumbed to the infection. Another was a British officer of the Egyptian Army; he, too, lost his life. Captain L. Bousfield, R.A.M.C., relates full details of eight instances of the disease in which the diagnosis was confirmed by the discovery of the Leishman body.

The report of the travelling Pathologist and Protozoologist, C. U. Wenyon, M.B., B.Sc., Protozoologist of the London School of Tropical Medicine, is a document of nearly fifty pages. He observed the entrance of Guinea-worm embryos into cyclops, and confirmed Leiper's statement that the gastric juice destroys the cyclops, but leaves the Guinea-worm embryo unharmed. Malaria prevails throughout the Southern Sudan. Syphilis, leprosy, mycetoma, and ainhum were seen. Dr. Franz Werner contributes a paper on the "Poisonous Snakes of the Anglo-Egyptian Sudan," eight species of which are known. The helminthes collected by Dr. Weynon are described by R. T. Leiper, the Helminthologist of the London School of Tropical Medicine, who gives useful directions for the preservation and hardening of specimens.

Harold H. King writes the report on Economic Entomology. He confirms Major Smith's observations on the breeding of flies in sun-dried human dejecta. An account of new mosquitoes from the Sudan and a table of all known Sudanese species are furnished by F. V. Theobald. The native methods of treatment of diseases in Rassala are related by Captain Bousfield. Captain R. G. Anderson, R.A.M.C., describes medical practices and superstitions in Kordofan. To Dr. D. Waterson was allotted the task of analysing the anthropological material collected by the late Dr. MacTier Pirrie.

Dr. Wm. Beam reports on the work of the Chemical Section. The water of certain wells in Kordofan is poisonous on account of the excess of nitrates, 6·5 grains per litre.

Among the many beautifully coloured plates are two of herpetomonas from the intestine of a flea, from *Tabanus socius*, and from a mosquito. An acquaintance with these is important on account of their resemblance to the flagellated forms of the Leishman body. It might be erroneously assumed that these insects were intermediate hosts of the kala-azar parasite.

This scant notice can give but an imperfect impression of the vast extent of the original matter presented in this volume. These reports reflect great credit on the Director and his collaborators. They will remain standard works of reference on all biological and chemical subjects connected with Egypt and the Sudan.

The Supplement, the joint production of Dr. Balfour and Captain Archibald, R.A.M.C., is a compendium of recent research. Its utility is greatly enhanced by the alphabetical arrangement of the articles. The

labour bestowed upon it has been immense. The authors are to be congratulated on having amply fulfilled their desire—to place before investigators beyond the reach of libraries a compact guide to new discoveries and papers on the subjects indicated. Its place is taken by no other work. It will prove to be of the greatest assistance to officers of our Corps, to whom we strongly recommend it. C. B.

WHY AND HOW THE SURGEON SHOULD ATTEMPT TO PRESERVE THE APPENDIX VERMIFORMIS. By C. B. Keetley, F.R.C.S.Eng.

In this paper, which was read before the Surgical Section of the Royal Society of Medicine on November 10th, 1908, and was briefly summarised in the *Lancet* of November 21st, 1908, and the *British Medical Journal* of November 28th, 1908, the author brings forward much evidence in support of his view that the appendix is a valuable organ and one that should not be lightly sacrificed, even if it is inflamed and causing danger to the patient. After a short historical note on the history of appendicostomy for various conditions, the advantages of transplantation of the diseased appendix into the abdominal wall as compared with the usual operation of removal of the appendix are discussed. Stress is laid on the fact that in an appendix so transplanted the danger of even perforation is minimised, while the appendix can be opened at any time for any of the conditions requiring an appendicostomy. The author holds that "an appendix transplanted is an appendix disarmed," and quotes the opinions of Macewen and of Metchnikoff as to the probable importance of this organ in the economy of the body. The selection of suitable cases for transplantation and the technique of the operation are then discussed. The value of appendicostomy in the treatment of chronic constipation, various forms of colitis, intussusception, and for the drainage of the bowel and the administration of food and hot water in serious abdominal cases is well brought out by the illustrative cases appended to the paper, and in conclusion the author replies to some of the objections urged against his views.

While fully admitting the value of appendicostomy in suitable cases, and its very great advantages over cæcostomy, we think that perhaps the author has attempted to prove too much. It seems hardly worth while to preserve a damaged appendix on the somewhat remote chance of it being some day required for an appendicostomy—an operation that is not likely to become at all common. With the author's suggestion that appendicostomy should be tried in the treatment of enteric we do not agree, and it is with some satisfaction we note that this heroic treatment has not yet been put into practice.

Whatever his opinion of the views expressed in this very interesting and suggestive paper may be, no surgeon can afford to ignore this method of treatment, the real value of which will only be settled after prolonged trial and the collection of a large number of cases. C. G. S.

Current Literature.

The Serum Diagnosis of Syphilis. — Porges' lecithin reaction, Klausner's water test, Sach's oleate of sodium, and Fornet and Schereschenewsky's precipitin reactions do not give constant results. On the other hand, Wassermann's method, a description of which was inserted in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, June, 1907, p. 568, has proved of the utmost value in the diagnosis of latent syphilis. It is in daily operation in Continental laboratories.

Tschernogubow (*Berliner klinische Wochenschrift*, November 23rd, 1908, p. 2107) describes the procedure which he adopts and claims to be simpler than Wassermann's.

We must consider the following scheme :—

(1) Blood corpuscles + hæmolytic amboceptor + complement = Hæmolysis.

(2) Blood corpuscles + hæmolytic amboceptor only = No hæmolysis.

(3) Blood corpuscles + complement only = No hæmolysis.

(4) Antigen + antibody + complement = Complement is fixed.

(5) Complement + antigen alone = Complement remains free.

(6) Complement + antibody alone = Complement remains free.

The freshly drawn blood of a syphilitic patient contains "complement," and what may be here described as a "syphilitic antibody" (it is not a true antibody, though in these experiments it behaves as one). If then an extract of syphilitic liver (here called the "antigen") be added to some of the blood diluted with a known quantity of physiological saline fluid, and the whole incubated at 38° C. for one hour, and then mixed with serum hæmolytic to human red blood-corpuscles which has been deprived of its complement by heating to 55° C. for one hour, and the mixture be again incubated, no hæmolysis will occur. For the "antigen" in the liver with the "antibody" in the syphilitic blood will have fixed the complement according to equation (4). Equation 1 will not be satisfied, since blood corpuscles and hæmolytic amboceptor alone remain. Equation 2 shows that this combination results in no hæmolysis.

If, on the contrary, there should be no "syphilitic antibody" in the suspected blood, the "antigen" in the liver extract alone will not be able to fix the complement (see Equation 5). Hence there will be present in the mixture : Blood corpuscles + hæmolytic amboceptor + complement, and hæmolysis will result according to equation 1.

Tschernogubow's technique is as follows : 0·1 cc. of blood is obtained from a finger prick, and is diluted to 1 cc. with physiological saline fluid and is placed in tube 1. A similar quantity of blood and saline are put in tube 2. Tube 3 contains 0·1 cc. of blood mixed with 0·9 cc. of liver extract solution.

To prepare the liver extract, small pieces of the syphilitic liver of a fœtus are dried in an apparatus through which flows a current of dry air

at 40° C. When desiccated, the liver is powdered, and 0·5 gramme of the powder is treated with 25 cc. of 95 per cent. alcohol for twelve to fifteen hours in the ice-chest. This is mixed with saline solution in the proportion of 1 part of the alcoholic extract to 50 or 200 parts of the physiological salt solution. The alcoholic extract undergoes no deterioration with age.

Tube 4 resembles tube 3 in its contents.

All the tubes are incubated for one hour at 38° C. Then 0·25 cc. of hæmolytic serum, deprived of its complement, is introduced into tubes 1 and 3. Into tubes 2 and 4 a similar quantity of physiological saline fluid is added. All the tubes are again incubated at 38° C. for two hours, then transferred to the ice-chest, and the results noted next morning.

In tube 1 hæmolysis has occurred, for it has contained blood corpuscles + hæmolytic amboceptor + complement, *vide* equation 1. Even if "syphilitic antibody" had also been present, the complement would have remained free since the "antigen" was absent (see equation 6).

No hæmolysis has taken place in tube 2, for in it are blood corpuscles and complement only, *vide* equation 3.

Tube 3 is the crucial experiment, and discloses the presence or absence of syphilitic antibodies. In it are blood corpuscles + complement + antigen. If antibodies are present, then the first incubation has enabled the combination (antigen + antibody) to fix the complement, equation 4. If no antibody is present, then the complement remains free, according to equation 5. Hence the subsequent addition of hæmolytic serum reveals the presence or absence of the antibody. If no hæmolysis is observed, this indicates that the complement has been fixed according to equation 4, and the conditions of equation 2 only exist. If hæmolysis has taken place, then the complement has not been anchored in the first incubation, which means that "antigen" alone is present (equation 5). Therefore, blood corpuscles, hæmolytic amboceptor and complement are existing together, and hæmolysis ensues (equation 1). Tube 4 contains blood corpuscles, complement, antigen and antibody, but no hæmolytic amboceptor, therefore hæmolysis does not take place (see equation 3).

C. B.

Hepatozoon perniciosum.—Miller, in *Bulletin* No. 46 of the United States Marine Hospital Service, describes a new hæmogregarine pathogenic for white rats. In the natural infection the parasite is chiefly found in an encysted form in the large lymphocytes, where it appears, when stained, as a pale blue mass of protoplasm containing a nucleus staining the same colour as the nucleus of the containing leucocyte; there is a capsule around the parasite which appears as a delicate unstained wall of even thickness. In the earlier stages of the infection, as seen in experimentally infected rats, the parasites are free in the plasma of the infected animal as actively moving vermicules; these are later taken up by the leucocytes and become encysted. Asexual division takes place exclusively in the liver cells, the parasite becomes embedded in the protoplasm of the liver cell, the nucleus divides until fifteen to twenty daughter nuclei are formed; these arrange themselves at the poles of the parasite, which eventually becomes converted into a bag of merozoites; this ruptures, and the merozoites are set free in

the blood-stream as full-grown actively moving vermicules which do not afterwards increase in size in the blood-stream.

The sexual stage of the parasite takes place in the body of a mite (*Lelaps echidninus*) which is parasitic on the white rat; the containing leucocyte is dissolved in the stomach juices of the mite, the parasite is set free, its capsule ruptures, and the parasite becomes an actively moving vermicule resembling the free forms found in the plasma of the rat. Later on these vermicules, in which one cannot distinguish any sexual differences, become paired; two parasites stick together at their extremities and eventually fuse, forming an ookinet which penetrates the stomach wall of the mite, and becomes free in the body cavity; after wandering about in the tissues of the body for a while, the ookinet comes to rest, its nucleus enlarges enormously and divides into a large number of fragments, which migrate to the periphery of what is now called a sporont. The surface of the sporonts becomes covered with a number of buds, each containing a fragment of the nucleus; these buds are set free, and constitute the sporoblasts, which again in their turn become encapsuled, and in the interior of which, by a further process of division, the sporozoites are formed: these are elongated sickle- or club-shaped bodies, which are set free in the stomach of the rat when it eats the infected mite, and which serve to carry on the infection. The author gives an elaborate description of the anatomy of the mite, as well as a *résumé* of our present knowledge of the hæmogregarines.

W. S. H.

The Use of Local Anæsthetics in the Army. By Méd. Major Buy (*A.M.P.*, October, 1908).—This writer comes to the following conclusions at the end of a long article discussing the various anæsthetics and methods of applying them:—

He is convinced of the superiority of locally applied anæsthetics, such as cocaine, tropocaine, eucaine, stovaine, alypine and novocaine (when it is possible to use them), over either chloroform or ether.

He has written the article to prove to regimental medical officers that they have in these anæsthetics a means of performing small operations in military hospitals harmlessly and without pain. No boil or abscess should be opened, nor tooth extracted, without administering one of these local anæsthetics; and every medical officer who has the well-being of his men at heart should take care to provide himself with the necessary means of using them.

Most medical officers in the French Army have only the ordinary Pravaz hypodermic syringe and powdered cocaine at their disposal. This syringe is difficult to sterilise. Its glass sides are too fragile and the piston with its indiarubber ring is easily put out of order when plunged into boiling water. Also, it is difficult to be absolutely exact in the measuring out of the few centigrammes of cocaine required for the work of the day, and any error might have grave consequences in the case of an alkaloid as poisonous as cocaine. In many French military hospitals, especially in the Val-de-Grâce, at Versailles and Bégin, local anæsthetics are the only ones used in the greater number of operations, notably for the radical cure of hernia.

The writer concludes by hoping that those medical officers who still use chloroform and ether because they are afraid of cocaine, will

substitute novocaine for the latter, and in future administer local anæsthetics as much as possible.

The author's notes on spinal anæsthesia are clear and good. He summarises the advantages as follows:—

(1) The procedure is simple and rapid.

(2) It can be carried out without assistance.

(3) The anæsthesia is as complete as with chloroform or ether; and, in operations on the lower part of the body, safer.

(4) It does not cause albuminuria.

(5) Vomiting is less frequent.

(6) It is beneficial when patients dread general anæsthesia and admits of nourishment being given immediately after operation.

The disadvantages are:—

(1) It should not be used in old patients or those subject to syncope except in small doses of 5 to 6 centigrammes of stovaine.

(2) The anæsthesia is sometimes incomplete or lasts only a few minutes (statistics of this are given), and then recourse has to be had to chloroform.

(3) Sometimes syncope or collapse occurs, and injections of caffeine have to be given.

(4) Severe headache and vomiting of a prolonged character sometimes occur after the operation.

(5) Paralysis of bladder and rectum may occur.

(6) Epileptiform seizures may occur, with syncope and cessation of respiration.

(7) Rarely there is rise of temperature.

(8) Cases of pain in legs, ocular paralysis, paralysis of all limbs have been noted, one case of paralysis of lower limbs lasting ten months.

(9) Difficulty in walking has been observed.

In consequence of these accidents and of the result of a recent discussion on the subject at the French Chirurgical Society, which disclosed their frequency and severity, M. Buy does not recommend spinal anæsthesia to his colleagues for use in the Army. In Germany novocaine has been substituted for stovaine in doses of 10 centigrammes for operations on the lower extremities and of 15 centigrammes for laparotomies in 5 per cent. solutions, but the same accidents have occurred.

The article generally is of much practical value as it gives detailed instructions for practising local anæsthesia by means of hypodermic injections, &c., careful note of the various anæsthetics in use, their nature, action, &c., with details regarding cocaine, tropocaine, eucaine, stovaine, alypin and novocaine. Detailed methods of producing local anæsthesia for the following operations are also given: circumcision, resection of scrotum for varicocele, dilatation of anus, radical cure of hernia, whitlow, and dental operations.

Contraindications to local anæsthesia are, too extensive an area of operation, cases where the limits of the operation cannot be determined beforehand, ulcerated tissues, which are very sensitive and render local anæsthesia illusory, inflamed tissues, the pain of which is only increased by the extra tension caused by injection of the anæsthetic solution, and operations on patients such as children and some adults who get alarmed at seeing the instruments and preparations for operation. According to

M. Buy local anæsthesia is indicated in strangulated hernia, tracheotomy and empyema, and some other operations where general anæsthesia has special dangers.

W. G. M.

The Influence of Rice on Beri-beri. By Dr. N. Mine (*Schiffs u. Tropen Hyg.*, September, 1908).—The real causes of this diseases are still unknown, but the fact has been established that it is most common among the rice-eating races. The success which attended Professor Takaki's experiments of substituting bread and barley for the rice ration in the Japanese navy gives cause for serious consideration. He affirms that the sailors' food contains too little proteid and too much carbohydrate, and that all the symptoms and anatomical changes caused by this disease are due to these two defects of nourishment.

Similar changes in diet carried out in the Dutch Navy and Army in Eastern Asia have shown equally successful results. The following table shows the improvement in the number of cases after barley had been substituted for rice :—

Year	Number of admissions per 1,000	Number of deaths per 1,000	Number invalided per 1,000
1885	370·40	11·36	2·60
1886	255·07	6·31	4·70
1887	171·35	3·44	3·01
1888	160·85	4·19	1·59
1889	194·75	5·26	2·60
1890	240·75	5·95	2·41
1891	263·83	5·65	2·98
1892	143·48	1·46	4·98
1893	35·19	0·97	3·42
1894	48·67	1·56	3·81
1895	37·00	1·33	2·27
1896	15·41	0·76	1·45
1897	10·06	0·58	0·82
1898	5·21	0·12	0·51
1899	1·21	..	0·13
1900	2·07	0·04	0·22

The improvement in the Japanese Army has been gradual since 1892, and since 1898 very rapid. The change in diet was first introduced into the 4th Division at the end of 1891, into the Division of Guards in 1892, into the 1st Division in 1893, into the 2nd and 3rd Divisions in 1894, and from 1898 into the entire Army. The decrease in the number of cases of beri-beri was in each case synchronous with the change of diet.

During the Russo-Japanese War the army was at first fed on rice, without any admixture of barley. It was only in June, 1904, in front of Port Arthur, when a great many cases of beri-beri were reported, that, despite all difficulties it was determined to give the troops a mixture of rice and barley ; and this was carried out until the end of the war. The number of cases at once decreased.

It is thought that Japanese rice is harmful. Takaki is of opinion that the poisonous matter is contained in a sort of fermentation of the husked rice. Another theory advanced by Professors Hirota and Sakurai is that the children of mothers who are suffering from the disease develop the symptoms, and lose them whenever they are suckled by healthy mothers, or get other forms of nourishment.

If it were true that rice grown in Japan is harmful, the nation would suffer far more from the disease than it does, for since the remotest ages rice has been one of the staples of the national diet. Yet since 1884 the nation has increased in population about 500,000 souls yearly.

Others who have studied the subject consider the want of proteids as the cause of the disease, but this view is not taken by Alfred Martinet, who gives the following table of analysis for rice, bread, and potatoes:—

	Water	Carbon hydrates	Proteids	Fats	Salts
Rice ..	14 per cent.	.. 77 per cent.	.. 7 per cent.	.. 1 per cent.	.. 1 per cent.
Bread ..	36 ,,	.. 55 ,,	.. 7 ,,	.. 1 ,,	.. 1 ,,
Potatoes ..	74 ,,	.. 22 ,,	.. 2·52 ,,	.. ..	.. 1 ,,

He says that these figures show that rice contains as much proteid as bread and two and a half times as much as potatoes. It has nearly half as much again of carbohydrates as bread and three times as much as potatoes, and is, therefore, more nourishing than bread and nearly three times more nourishing than potatoes.

Twelve years ago Professor R. Mori, after making experiments and having long experience with the Guard regiments, declared that rice was the best food for the Japanese soldier, and this opinion has also been expressed by other Japanese physiologists.

The Chinese in Southern Manchuria very seldom suffer from beri-beri. They live chiefly on millet. When, however, the Japanese were there, the disease broke out amongst the troops. Is this because the Japanese ate rice while the Chinese ate millet, and is rice grown in Japan harmful or not? These are questions which require answering before a certain remedy can be found.

Experiments have been tried of feeding Chinese on rice grown in Japan, and even on stale rice which has been exposed to rain for many hours, and which by some writers is supposed to contain the harmful germs. But in all cases of experiments of this kind, no cases of the disease occurred. On the other hand, in Port Arthur a case occurred of a Chinaman who developed beri-beri although he had always lived entirely on millet.

This all shows us that it is by no means certain that rice, even when it is in a bad condition, produces beri-beri, for it is found to occur when no rice is eaten. In Southern Manchuria during 1906 there was a considerable outbreak of the disease, until in 1907 the rations were changed to a mixture of rice and barley. The following are the figures:—

1906	591 cases	28 deaths.
1907	74 ,, ...	5 ,,

The best method of combating the disease is the isolation of those suffering from it. This is the chief cause of the diminution in the number of cases. Whenever possible, each sufferer was removed from his own dwelling to the hospital. This method will serve better than anything else to arrest an epidemic.

W. G. M.

The Use of Extension Splints for Transport of Fractures of the Thigh. By Stabsarzt Graf (*Deutsche Militärärz. Zeit.*, August 20th, 1908).—No fracture causes so much difficulty in transport, or is so liable to be badly influenced by transport, as fracture of the thigh. To a

certain extent it is a fact that complete recovery is only to be reckoned on when the patient can at once be taken to a stationary hospital and the limb placed in plaster of Paris. Often, however, especially in wars in the colonies, these conditions are impossible, and patients must be carried long distances, so that it is necessary to consider the best means of accomplishing such journeys.

The two methods of carrying—that of the chair-stretcher recommended by Helferich, and that of extension litters recommended by v. Esmarch—are both very successful when it is a question of transport over short distances, to the field hospitals for instance. But they are very unsatistory for long journeys, as a rigid position for the injured limb is impossible with both, and to obtain this stretchers or improvised stretchers must be used, which are often not procurable.

The best transport bandage, plaster of Paris, has certain disadvantages when used for the thigh. Before it can be applied the fracture must be set. This is frequently unsuccessful and requires great care and skill, and above all, plenty of time, more than can usually be spared to one wounded man under the circumstances.

Splints have this advantage over plaster—they are lighter and more quickly put on, but their drawback is that they no not remain rigidly fixed. The best splints are those recommended by v. Esmarch, Liston, and others, namely, those with an extension contrivance. They are long wooden splints with an extension at the end fastened to the leg with bandages.

The illustration to this article shows a Cramer splint, 2 metres long and 10 cm. broad, which is made of galvanised iron wire; besides being strong it is plastic and clings very close to the limb, keeping it quite straight. This particular splint is made by Bors, of Düsseldorf, costs 5½ marks (5s. 6d.), and has been brought up to the highest possible grade of strength compatible with lightness.

It is light, easily put together, and simple to adjust. It extends from the lowest rib right down the side of the patient to a hand's breath or two beyond the foot where it turns inwards at right angles forming a stirrup parallel to the sole of the foot. It is then turned back again over the stirrup and a short way up the leg. The inner side is thus greatly strengthened. The extension apparatus can be applied by means of a rounded wooden block, which can be fastened on to the outside of the stirrup and fixed by bandages to the ankle. In order that the iron wire between the fastenings should not be compressed, it is advisable to place a strip of wood between the block and the stirrup of the splint.

For transport, however, the splint is not yet sufficiently firm, and it must be strengthened by splints made of pasteboard, &c., placed on the front and back of the thigh, and fastened with gauze or plaster bandages to the uninjured limb. Finally, the extension fastened to the foot can be removed if it is found that transport is causing jarring; this, however, should not be the case if the patient is carefully placed on the litter.

The Cramer splint is well adapted for use in the field. It is equally useful for upper and forearm fractures, and with the help of strips of sticking plaster and blocks, extensions for these can also be made. They are, however, seldom required for these fractures.

W. G. M.

Correspondence.

CO-EXISTENCE OF ENTERIC FEVER AND MALARIA IN THE SAME PATIENT.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—In the matter of the frequency of the co-existence of enteric fever and malaria in the same patient, in India, my experience entirely coincides with that of Captain Smallman, as recorded in the February number of the Journal.

At Mian Mir, in the highly malarious year, 1903, it was quite a common thing to find malarial parasites in the blood of typical enteric patients. In fact, most patients who were in hospital for any cause acquired malaria there.

I am afraid Captain Smallman's claim to be the first to have observed the malarial parasite and to have isolated the *Bacillus typhosus* from the same patient cannot be substantiated. Scheube, in "The Diseases of Warm Countries" (p. 126, second revised edition, 1903), says: "Lately, the proof of the simultaneous existence of the two infections has been furnished by Vincent, Namack, Lyon, Craig and others, by the demonstration of malarial parasites in the blood, and typhoid bacilli in the intestinal canal and in the spleen, and also by the positive results of the Gruber-Widal serum reaction in typho-malarial patients."

I am, Sir, &c.,

E. P. Sewell,
Captain, R.A.M.C.

Belfast,
March 13th, 1909.

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Original Communications.

AN EXPERIMENTAL RESEARCH ON THE VIABILITY OF THE *BACILLUS TYPHOSUS* AS EXCRETED UNDER NATURAL CONDITIONS BY THE "CHRONIC CARRIER."

BY MAJOR J. C. MORGAN AND CAPTAIN D. HARVEY.
Royal Army Medical Corps.

RESULTS of experiments have been recorded from time to time which would tend to show that typhoid bacilli have a fairly prolonged existence outside of the human body, but practically all these experiments have been conducted with laboratory cultures of the bacillus.

Occasionally it is stated that a culture recently isolated from a case of typhoid fever had been utilised. For example, in 1902, Firth and Horrocks[1] published the results of some careful experiments designed to ascertain the period of life of the typhoid bacillus in soil and on fabrics, &c., but all these experiments, with one exception, were carried out with cultures of the bacillus. They were able to recover the bacillus from soil after two months, and from fabrics, such as khaki drill, serge, &c., up to eighty-seven days.

These results have been confirmed more recently by other observers.[2] We believe the conclusions naturally drawn from these experiments to be erroneous; and that the error is due to the fact that subcultures of the typhoid bacillus were used and not the

[1] Firth and Horrocks, *British Medical Journal*, 1902.
[2] Mair, *Journal of Hygiene*, January, 1908.

bacillus as it is passed in nature in the excreta of enteric convalescents and the "chronic carrier."

The report of the Enteric Fever Commission[1] published in August of 1908 contains records of experiments carried out on somewhat similar lines, though differing in this respect in that the material used was the excreta of enteric convalescents.

As the "Scientific Memoirs of the Government of India" in which these reports are published may not be readily available to readers of this Journal, it may be as well to quote some of these experiments.

Experiment I.—The urine of a convalescent enteric patient, which gave a count of 60,000,000 bacilli per cc. in pure culture as counted on a Conradi-Drigalski plate, was placed in a urine glass on a bench in the laboratory at room temperature, and not exposed to sunlight. In seventy-two hours typhoid bacilli could no longer be recovered from the urine.

Experiment II.—A small portion of specially infected fæces from a convalescent patient, which was found to contain 10,000,000 typhoid bacilli to the gramme, was spread between pieces of blanket, and placed in a Petri dish on a dark shelf. By the sixth day typhoid bacilli could no longer be recovered from this material, although recovered in large numbers on the first and subsequent days.

Experiment III.—Several grammes of the same sample of fæces as was used in Experiment II. were emulsified in normal saline solution and kept at room temperature. Typhoid bacilli were recovered up to the fourth day, but not later.

Much attention has been directed to the *rôle* of the "chronic carrier" in the causation of enteric fever, and, as we had under examination here in the recently established Enteric Convalescent Depôt several cases of this nature, it was decided to conduct a series of experiments to ascertain how long soil, water, and fabrics, polluted by specifically infected excreta, retained the contagium. Our experiments differed, however, from those carried out by the Enteric Fever Commission, in that the material used by them was, with one or two exceptions, the excreta either of men suffering from enteric fever or only just convalescent from the disease, and who shortly afterwards ceased to pass the bacillus in their excreta. We have worked entirely with men who were daily passing the bacillus in their excreta, and who had suffered from enteric fever more than six months previously, who were

[1] "Scientific Memoirs of the Government of India," 1908.

otherwise in excellent health, and who, but for the establishment of this depôt, would have been at duty and distributing the bacillus freely in and around barracks.

Before proceeding to record these experiments it may be well to state that one of us (D. H.) was a member of the Enteric Fever Commission, and had done a year's work in the daily examination of Conradi-Drigalski plates prepared from the excreta of normal men, enteric fever cases, and convalescents. Also during the past eight months we have carried on the same work in connection with the Enteric Convalescent Depôt. It will thus be understood that we were possessed of the necessary expert knowledge to carry out this experimental research, and that the work was not taken up as a side issue, but was part of the daily routine.

Gunner C. had enteric fever in March, 1901, and in October was still passing the bacillus in large numbers almost daily in his fæces. His blood serum gave the following agglutination reactions :—

			Dilution of serum		
		1 in 20	1 in 40	1 in 100
2.7.08	Laboratory strain	+	+	±
9.9.08	His own strain	−	−	−
14.11.08	Laboratory strain	+	±	±
14.11.08	His own strain	+	±	trace.

Bombardier S. had enteric fever in Fyzabad in May, 1908, and was still passing the bacillus in pure culture daily in his urine in November. His blood serum gave the following agglutination reactions :—

		Dilution of serum			
		1 in 20	1 in 40	1 in 100	1 in 200
3.9.08	Laboratory strain	+	+	+	±
3.9.08	His own strain	+	+	+	±

The highest count was 50,000 bacilli per cc., and as a rule there were from 4,000 to 8,000 per cc. in his urine. The reaction of his urine was acid, it contained no albumen or blood, and invariably appeared quite clear to the naked eye.

It has been stated that the condition of bacilluria can be recognised macroscopically by the cloudiness of the urine. We have found by experiment that a urine which contains 20,000,000 bacilli per cc. will only show a faint haze, and that a sample containing under 10,000,000 appears perfectly clear to the naked eye. The work of the Enteric Fever Commission has demonstrated that counts higher than these are exceedingly rare, and that therefore any conclusions based on grounds other than direct cultural examinations are entirely fallacious.

Experiment I.—A piece of ground was selected on the side of

a path at the depôt, and Bombardier S. micturated under personal supervision on this patch at 8 a.m. on October 23rd, and at the same time passed a portion of his urine into a sterilised Erlenmeyer flask. The flask was brought to the laboratory and 5 cc. of the urine was plated out direct on to a Conradi plate. On incubation this plate gave a count of 4,000 typhoid colonies per cc. The piece of ground selected was exposed to direct sunlight for three and a half hours, from 1 p.m. to 4.30 p.m. The soil was very dry and consisted of small stones and shale detritus. The temperature of the sun's rays was as follows: 110° F. at 4 p.m. Shade temperature: Dry bulb 52° F.; wet bulb 48° F.; all taken at 4 p.m. The minimum temperature at night was 48° F. No rain fell during the experiment.

On the following morning (the 24th) Bombardier S. again micturated on the same spot of ground, and a sample taken at the same time and plated out as before gave a count of 26,000 bacilli per cc. At 1 p.m. the same day, *i.e.*, six hours after pollution, 2 grammes of soil were taken from the moist patch, placed in a sterile test-tube and washed thoroughly in 2 cc. of ordinary tap-water, the solid matter was allowed to sediment and the supernatant fluid drawn off with a pipette and plated out on two 10-inch Petri dishes of Conradi medium. These were incubated, and on the following morning showed some hundreds of typhoid colonies.

At 1 p.m. on the following day, *i.e.*, thirty hours after pollution of the soil, a similar procedure was gone through, but no typhoid colonies were found on the plates prepared, nor subsequently.

On one occasion, October 27th, 50 grammes of the polluted soil were taken, washed, and the washings filtered, brushed and plated out, but no typhoid colonies were found.

Table I.

23.10.08 ..	Urine passed on to soil, 9 a.m.		
24.10.08 ..	,, ,, 7 a.m.		
			Result
24.10.08 ..	Sample collected ..	1 p.m.	*B. typhosus* present.
25.10.08 ..	,, ..	1 p.m.	No *B. typhosus*.
26.10.08 ..	,, ..	1 p.m.	,, ,,
27.10.08 ..	50 grammes collected	1 p.m.	,, ,,

This experiment was repeated with the following variations :—

Experiment II.—Bombardier S. micturated, under personal supervision, in the dark corner of a small wooden hut with earthen floor at 6 a.m. on October 30th. A count of this urine showed 50,000 typhoid bacilli in pure culture per cc. At 11.30 on the same day,

i.e., five and a half hours after pollution, a sample of soil was collected, washed, sedimented, and plated out as before. After incubation the plates showed numerous colonies of *B. typhosus*. At 6 p.m. another sample of this soil was collected and treated as before, but, unfortunately, only one plate was available, and as it was overgrown with other colonies no opinion could be given.

The following day and on November 1st, another sample was collected and plated out, but no colonies of *B. typhosus* were found, nor subsequently.

Table II.

30.10.08 ..	Urine passed on to soil in hut, 6 a.m.			
30.10.08 ..	Sample collected	11.30 a.m.	*B. typhosus* present.	
30.10.08 ..	,, ...	6 p.m.	Plate overgrown.	
31.10.08 ..	,, ...	11.30 a.m.	No *B. typhosus*.	
1.11.08 ..	,, ...	11.30 a.m.	,,	,,
2.11.08 ..	,, ...	11.30 a.m.	,,	,,

Experiment III. — On November 10th, 11th, and 12th, at 6.30 a.m., Bombardier S. micturated on the same patch of ground in the corner of the hut. On these occasions no count was made, so it was not known whether he was passing typhoid bacilli. At 11.30 a.m. on November 12th, *i.e.*, five hours after the last pollution of the soil, a sample was taken and plated out as before. The plates showed very numerous colonies of the *B. typhosus*. At 12 noon on November 13th, *i.e.*, thirty hours after the pollution of the soil, another sample was taken, and from this one or two typhoid colonies were isolated. Although examined daily thereafter for some time no more typhoid bacilli were found.

Table III.

10.11.08 ..	Urine passed on to soil in hut, 7 a.m.		
11.11.08 ..	,, ,, ,,	7 a.m.	
12.11.08 ..	,, ,, ,,	7 a.m.	
12.11.08 ..	Sample collected	11.30 a.m.	*B. typhosus* present.
13.11.08 ..	,, ...	11.30 a.m.	,, ,,
14.11.08 ..	,, ...	11.30 a.m.	No *B. typhosus*.
15.11.08 ..	,, ...	11.30 a.m.	,, ,,

Experiment IV.—As a check on the experiments conducted in the open air, a box of garden soil was taken and 150 cc. of Bombardier S.'s urine, containing 50,000 typhoid bacilli per cc., were poured on to the surface of this soil at 12.30 p.m. on October 30th. The box was placed open in the laboratory exposed to daylight, but not to sunlight.

At 6 p.m. on the same day a sample of this soil was collected, washed, sedimented, and plated out. Result, the *B. typhosus*

was recovered in practically pure culture from the first plate, and there were over 100 colonies on the second plate.

On October 31st, at 1 p.m., *i.e.*, twenty-four hours after contamination, a sample was collected and plated out as before. Result, several colonies of *B. typhosus* were found on the second plate. On this occasion it was noted that the plates showed numerous colonies other than those of typhoid. On November 1st the experiment was repeated, with a negative result as regards the recovery of the *B. typhosus*. On November 2nd the experiment was again repeated, but with negative results.

In all these soil experiments care was taken to obtain samples both from the upper and lower layers of the moistened soil. As a matter of practical experience it was found that when a urine is passed on to dry soil it does not percolate to a greater depth than two or three inches.

TABLE IV.

29.10.08	..	150 cc. urine poured on to box of garden soil in laboratory at 12.30 p.m.
29.10.08	..	Sample collected at 6 p.m. .. .. *B. typhosus* present.
30.10.08	..	,, 1 p.m. .. .. ,, ,,
31.10.08	..	,, 1 p.m. .. .. No *B. typhosus*.
1.11.08	..	,, 1 p.m. .. .. ,, ,,

Experiment V.—On one of the occasions when Bombardier S. had micturated on to the ground he was directed, after adjusting his dress, to pass his fingers over the surface of a Conradi plate, which was subsequently incubated. This plate on the following morning showed six or seven colonies of the *B. typhosus*.

EXPERIMENTS CARRIED OUT TO SHOW THE VIABILITY OF THE B. TYPHOSUS ON COTTON FABRICS SOAKED IN THE URINE OF A "CHRONIC CARRIER."

Experiment VI.—On October 24th a piece of towelling was soaked in the urine of Bombardier S. At the same time 0·5 cc. of this same urine was plated out and gave a count of 26,000 typhoid bacilli per cc. The piece of towelling was dried in the air and exposed to daylight. Three days later about a square inch of the towelling was moistened in tap-water and rubbed over the surface of a Conradi plate. This procedure was repeated on October 29th and November 2nd, with the addition that the square inch of towelling used was dropped into a tube of bile medium, which was then placed in the incubator. On the following day plates were prepared from the bile medium. On none of these occasions

was the typhoid bacillus recovered from the pieces of towelling used.

Experiment VII.—The preceding experiment was repeated with the following variation. On October 30th a piece of towelling was soaked in a sample of urine which was found to contain 50,000 typhoid bacilli per cc. This piece of towelling was cut into two pieces and both were placed in Petri dishes, one exposed to ordinary daylight and the other kept in the dark. A similar technique was followed as in the previous experiment, and the results will be seen in the attached table.

TABLE V.

Date	Material	Medium	Result
30.10.08	Towelling soaked in urine of Bomb. S. 1 cc. contains 50,000 typhoid bacilli		
31.10.08	Dark Towel	Conradi	+
	Light Towel	Drigalski	+
2.11.08	Ditto (D.T.)	Ditto	+
	Ditto (L.T.)	Ditto	+
3.11.08	Ditto (D.T.)	Ditto	+
	Ditto (L.T.)	Ditto	−
5.11.08	Ditto (D.T.)	Ditto	−
	Ditto (L.T.)	Ditto	−
	Ditto (D.T.)	Bile	−
	Ditto (L.T.)	Medium	−
7.11.08	Ditto (D.T.)	Conradi	+
	Ditto (L.T.)	Drigalski	−
9.11.08	Ditto (D.T.)	Ditto	+
	Ditto (L.T.)	Ditto	−
10.11.08	Ditto (D.T.)	Ditto	+
	Ditto (L.T.)	Ditto	−
14.11.08	Ditto (D.T.)	Ditto	−
	Ditto (D.T.)	Bile	−
16.11.08	Ditto (D.T.)	Ditto	−
	Ditto (D.T.)	Ditto	−

D.T. = Towelling kept in the dark.
L.T. = Towelling exposed to daylight.

It will be noted that typhoid bacilli could be recovered from the portion of towelling exposed to daylight up to and including the fourth day after pollution, but not later. From the portion which was kept in the dark they were recovered up to and including the eleventh day, but not later.

Experiments carried out to ascertain the Viability of the B. typhosus when passed into Water.

Experiment VIII.—On October 24th 1 cc. of urine diluted with 9 cc. of ordinary tap-water was placed in a test tube and kept at room temperature for one hour; 0·2 cc. of this was planted out and showed 520 colonies of the *B. typhosus* in pure culture. The test tube was put aside and the experiment repeated on the 27th and gave a negative result as regards the *B. typhosus*. In this experiment two 10-inch plates were used, and although the colonies were well separated from one another on the second plate, no typhoid colonies could be found.

Experiment IX.—On November 17th, at 12 noon, 50 cc. of Bombardier S.'s urine were poured into two gallons of tap-water. The urine gave a count of 4,000 bacilli per cc. At 2 p.m. on the same day 1 cc. of this water was plated out, with the result that on the following day six colonies of the *B. typhosus* were found on this plate.

At the same time 500 cc. of this water were placed in a tall glass and precipitated with alum. The precipitate was collected and plated out, and a portion also placed in bile medium, but in neither instance was the *B. typhosus* recovered.

On November 18th an additional 150 cc. of urine containing 6,000 typhoid bacilli were poured into the same water.

On the 19th, *i.e.*, twenty-four hours after the last pollution, 1 cc. of the water was plated out direct, with a negative result: 500 cc. of the water were precipitated with alum and the precipitate plated out, some of it also was placed in bile medium, in both cases with negative results.

On the following day, November 20th, 50 cc. of this same water were placed in 160 cc. of bile medium, incubated and plated out. No *B. typhosus* could be found. The plates showed a profuse growth of *Bacillus prodigiosus*. It will thus be seen that on only two occasions were we able to recover the *B. typhosus* from water richly infected with the urine of a chronic bacillus carrier. On one of these occasions numerous typhoid colonies were found on a plate prepared from the water shortly after pollution, and on the other a few colonies were found on a plate prepared two hours after pollution. These experiments tend to confirm the already accepted impression that the life of the typhoid bacillus in water is an exceedingly short one.

A somewhat similar series of experiments were carried out with milk.

Experiment X.—Two flasks, each containing 50 cc. of fresh unboiled milk, were taken. One of these was heated to 80° C. for twenty minutes and then rapidly cooled. To both flasks a few drops of Bombardier S.'s urine were added and the flasks placed in the incubator. At the time this sample was taken Bombardier S. was on urotropine. The following day a small portion of the milk from each flask was plated out. The *B. typhosus* was recovered in practically pure culture from the pasteurised flask. The plates from the unsterilised flask showed almost a pure growth of coli colonies, but although these colonies were quite separate on the second and third plates no typhoid colonies could be found. This experiment demonstrates the well-known fact that the growth of a delicate organism such as the *B. typhosus* is favoured in a medium freed from antagonistic bacteria, and also is inhibited by the free growth of the same, and incidentally shows the danger of the subsequent contamination of pasteurised milk by pathogenic organisms.

Experiments undertaken to Test the Efficacy of Urotropine on a Man who was passing the Typhoid Bacillus daily in his Urine.

It appears to us to be a generally accepted opinion that urotropine has the power of preventing the growth of the typhoid bacillus in the urine of men convalescent from enteric fever. This opinion is apparently based on observations carried out on men who have recently passed through an attack of enteric fever. The work of the Enteric Fever Commission has established the fact, and this has been confirmed by the experience gained in this depôt, that in the vast majority of cases the *B. typhosus* spontaneously disappears from the urine as convalescence is established.

It was also noted by the same observers that the administration of urotropine did not prevent the reappearance of typhoid bacilluria, although this bacilluria subsequently spontaneously disappeared.

It is obvious that in many cases this spontaneous disappearance of the bacilluria has coincided with the administration of the drug to such cases, which has been assumed to be the cause of the result obtained.

Experiment XI.—On November 17th Bombardier S. was found to be passing urine containing 4,000 typhoid bacilli per cc.

On November 18th he was given 10 grains of urotropine three times a day. The urotropine was obtained from the Medical Store Depôt, and was administered under personal supervision. The table attached gives the results in detail.

Table VI.

18.11.08	..	Bombardier S. placed on urotropine, 10 grains, *t.i.d.*
17.11.08	..	4,000 typhoid bacilli per cc.
18.11.08	..	6,000 ,, ,,
19.11.08	..	*B. typhosus* present.
20.11.08	..	,, ,,
21.11.08	..	,, ,,
22.11.08	..	Urine not received.
23.11.08	..	10,000 per cc.
24.11.08	..	*B. typhosus* present.
25.10.08	..	10,000 per cc.
26.11.08	..	*B. typhosus* present.
27.11.08	..	Plate overgrown.
28.11.08	..	8,000 per cc.
29.11.08	..	2,000 per cc.
30.11.08	..	*B. typhosus* present.
1.12.08	..	More than 10,000 per cc.
2.12.08	..	*B. typhosus* present.
3.12.08	..	,, ,, Urotropine stopped.
4.12.08	..	More than 10,000 per cc.
5.12.08	..	,, ,,
21.12.08	..	4,300 per cc.
22.12.08	..	30,000 per cc.

He received in all 450 grains of urotropine and it will be noted that the drug had not the slightest effect on the condition. The drug was not pushed in larger doses, as the doses given are those ordinarily administered, and are in excess of those recommended by the manufacturers; and, moreover, at least two men who suffered from hæmaturia, the result of the administration of this drug in smaller doses than the above, are now at the depôt.

Experiments undertaken to test the Viability of the B. typhosus in the Stools of a "Chronic Carrier" under the Conditions obtaining in a "Dry-earth" Latrine.

Experiment XII.—Gunner C. was directed to pass his stool into a gumlah half filled with dry earth. The stool was then covered over with dry earth and the gumlah placed in a shed and covered over with a board. A portion of the fæcal matter was taken on the same day, emulsified, and plated out, and showed numerous colonies of the *B. typhosus* in almost pure culture. The following day a similar portion was taken, emulsified, and plated out, and eighty typhoid colonies were counted on this plate. The same procedure was carried out from time to time, with results that will be seen on reference to the attached table.

TABLE VII.

12.11.08	..	Stool of Gunner C. passed into dry-earth gumlah.
12.11.08	..	Sample plated out .. .. .. *B. typhosus* present.
13.11.08	..	,, ,, ... ,, ,,
15.11.08	..	,, ,, ... *B. typhosus* present; coli increasing.
16.11.08	..	,, ,, ... *B. typhosus* present; coli numerous.
17.11.08	..	,, ,. .. .. .. *B. typhosus* present.
18.11.08	..	,, ,, ... No *B. typhosus*.
20.11.08	..	,, ,, from interior .. *B. typhosus* present.
22.11.08	..	,, ,, ... ,, ,,
25.11.08	..	,, ,, ... No *B. typhosus*.
27.11.08	..	,, ,, ... ,, ,,
29.11.08	..	Large sample from interior .. .. *B. typhosus* present.
1.12.08	..	,, ,, ,, ,, ... No *B. typhosus*.
3.12.03	..	,, ,, ,, ,, ... ,, ,,

Nor subsequently.

On November 17th it was noted that the fæcal mass had become hard and dry, and a sample taken from the outer portion gave a negative result. The fæcal mass was then broken into and a portion taken from the more or less moist interior, emulsified and plated out, and gave a positive result, but only a few colonies could be found. This procedure was again repeated on the two following days with a similar result; but with negative results thereafter. The mass was then again broken up and a large portion, weighing approximately 6 grammes, was taken, broken up, and emulsified, and plated out. From this a few colonies of the *B. typhosus* were recovered. This same procedure was again repeated two days later with, however, a negative result, nor could any typhoid bacilli be isolated subsequently.

The above experiment shows that under the conditions that obtain in a dry-earth closet, and in dry-earth methods of disposal of excreta, the *B. typhosus* can readily be recovered up to a week and can exist in the interior of a dried fæcal mass up to eighteen days, and indicates also how easily the infection could be conveyed by flies from such material when left exposed in a latrine pan.

EXPERIMENTS UNDERTAKEN TO TEST THE VIABILITY OF THE B. TYPHOSUS ON WOOLLEN FABRICS SOILED WITH EXCRETA FROM A "CHRONIC CARRIER."

Experiment XIII.—A portion of fæces, weighing about a gramme, obtained from the same patient as in the above experiment, was thickly smeared between two pieces of ordinary grey

blanket. The blanket was placed in a Petri dish and kept in a press exposed to daylight, but not to sunlight. Typhoid bacilli were recovered up to and including the fourth day, but not subsequently.

TABLE VIII.

12.11.08	..	Sample smeared on blanket.	
14.11.08	..	Sample plated out	*B. typhosus* present.
15.11.08	..	,, ,, ...	No *B. typhosus*.
16.11.08	..	,, ,, ...	,, ,,
16.11.08	..	Bile medium	*B. typhosus* present.
18.11.08	..	Sample plated out	No *B. typhosus*.
18.11.08	..	Bile medium	,, ,,

Nor subsequently.

On November 25th a fresh sample of fæces from the same case was smeared between blanketing and the experiment repeated. On this occasion the *B. typhosus* was recovered at every examination up to and including the fortieth day, but not after.

In this experiment the sample used was a liquid stool (the result of a saline aperient), and portions of blanket fibre were pulled out from the soiled portion and used for this experiment.

TABLE IX.

25.11.08	..	Sample smeared on blanket.	
26.11.08	..	Sample plated out ..	*B. typhosus* present; pure culture.
28.11.08	..	,, ,, ..	,, ,, ,,
30.11.08	..	,, ,, ..	No *B. typhosus*.
1.12.08	..	,, ,, ..	*B. typhosus* present.
3.12.08	..	,, ,, ..	,, ,,
5.12.08	..	,, ,, ..	,, ,,
9.12.08	..	,, ,, ..	,, ,,
12.12.08	..	,, ,, ..	,, ,,
15.12.08	..	,, ,, ..	,, ,,
20.12.08	..	,, ,, ..	,, ,,
24.12.08	..	,, ,, ..	,, ,,
30.12.08	..	,, ,, ..	,, ,,
3.1.09	..	,, ,, ..	,, ,,

But not subsequently.

THE ORGANISATION OF THE ARMY FOR THE EVACUATION OF SICK AND WOUNDED.

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The following notes are intended as an "appreciation" of the organisation of the Army, with special regard to the removal of sick and wounded from field medical units to the lines of communication. The subject matter has mainly been extracted from official sources, and I am also much indebted to Lieutenant-Colonel W. G. Macpherson, C.M.G., R.A.M.C., for valuable information and advice.

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The medical service in the field is based on a system of evacuation of the sick and wounded, and on the efficiency of this system largely depends the mobility and "moral" of the Army. The medical organisation may be considered in three zones: firstly, the collecting zone consisting of the medical establishments of regimental units, field ambulances, and cavalry field ambulances; secondly, the evacuating zone consisting of clearing hospitals and ambulance trains; thirdly, the distributing zone consisting of stationary hospitals, general hospitals, hospital ships, and the military hospitals in the United Kingdom.

It is the linking up of the units of these various zones and the proper utilisation of the means of transport available with the Army, or attached to the Army in special circumstances, that constitutes one of the chief problems before all administrative officers of Medical Service, from the Director of Medical Services downwards.

One of the principles of our organisation for the removal of wounded from the field (collecting zone) to the evacuating zone is that the ambulance wagons of field ambulances, &c., should never be detached to such a distance as would prevent them rejoining their unit the same day; it is also intended that the empty wagons of supply columns and parks, returning to be replenished at the advanced depôt, should be utilised for the conveyance of sick and wounded; and in addition the provision, by hiring or requisition, of auxiliary sick transport after an action, or the utilisation of specially organised sick and wounded convoys, is contemplated.

Auxiliary bearer columns provided from private resources or the Red Cross Society are also indicated as possible aids for this work.

All such improvised arrangements, however, require special consideration and organisation for any particular campaign.

While these auxiliary organisations cannot very definitely be studied in our war regulations, the organisation of supply columns and parks, from the point of view of sick transport *in posse*, can be studied and should be carefully considered by medical officers. For the purpose of the following notes an outline of the supply organisation may be useful.

The accompanying diagram from a recent official publication shows the supply arrangements between the advanced depôt and the fighting troops of a division :—

From the advanced depôt a divisional transport and supply park consisting of three sections (one horsed and two mechanical) is capable of stringing out to the extent of two and a half days' marches, and each section contains rations for a division for one day. Rations are loaded at the advanced depôt into empty wagons of No. 3 Section of the divisional transport and supply park. These go forward and are loaded into No. 2 Section, and from No. 2 into No. 1 Section. The communication between No. 1 Section of the park and the second line transport of the division is through the divisional transport and supply column, which works between the "head" of the park and points about half a day's march behind the division.

Stores taken over from No. 1 Section of the transport and supply park are carried up on the transport and supply column, and thence loaded into the regimental supply wagons and so carried to the troops. The point where the regimental supply is to connect with the transport and supply column is indicated in divisional operation orders, so that units may know to what point to send their second line transport. Similarly the position of the advanced depôt is also indicated in Army operation orders.

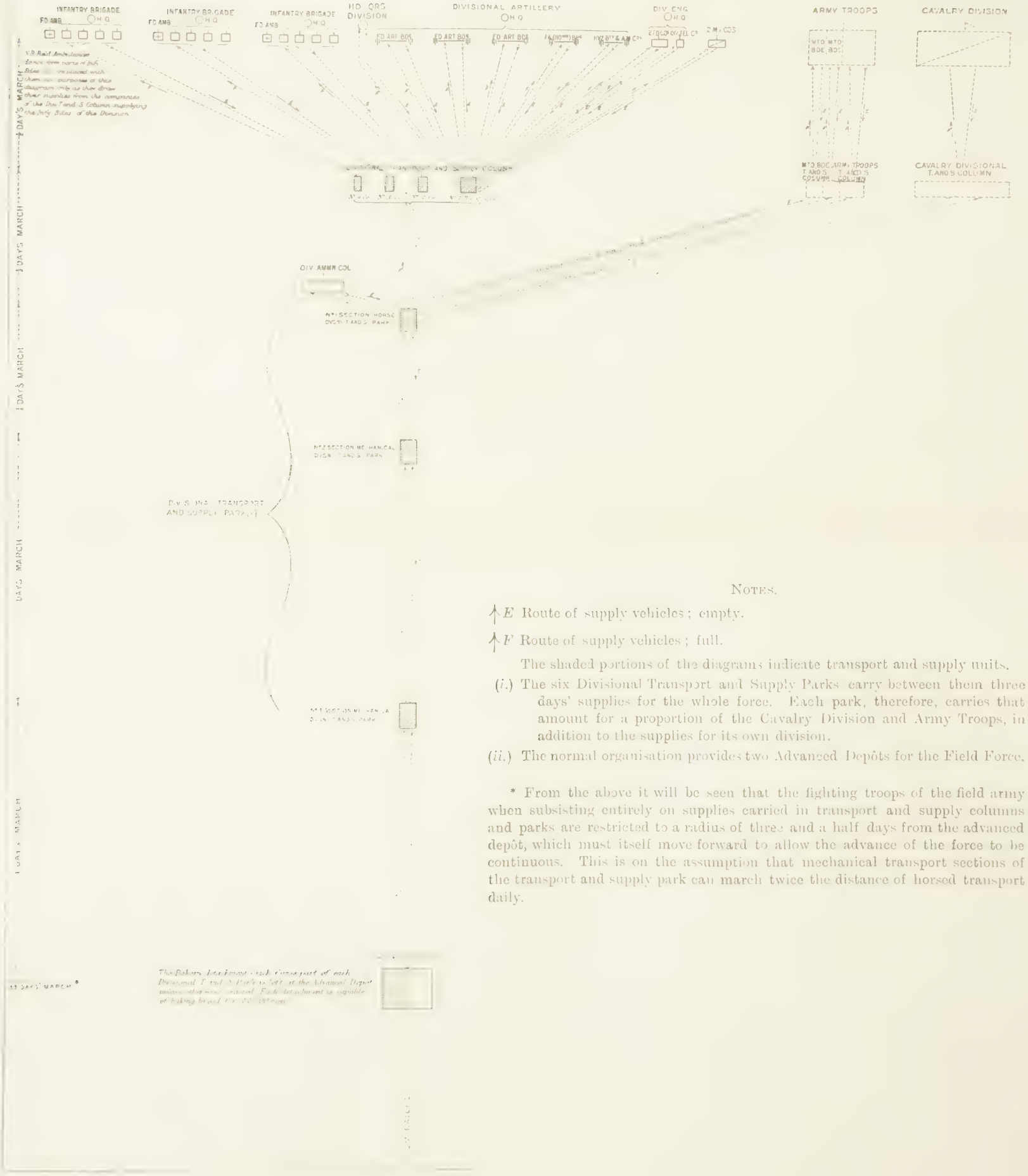
It must be understood that although these lines—the second line transport, the divisional transport and supply column, and the divisional transport and supply park—are capable of stringing out to the distance of three and a half days' march, this is not always necessary, and the distance between the "head" of the transport and supply column and the advanced depôt ("tail" of the transport and supply park) may be much shorter. It is down this series consisting of the transport and supply column and the sections of the transport and supply park that the normal evacuation of the sick and wounded takes place.

The first question that arises is, What transport is available in

SUPPLY OF THE FIELD ARMY.

(This diagram is not drawn to scale, and does not represent the tactical disposition of the fighting troops, but merely indicates the successive échelons of the supply organisation for the field units.)

I.—Supply of a Division.



Notes.

↑*E* Route of supply vehicles; empty.

↑*F* Route of supply vehicles; full.

The shaded portions of the diagrams indicate transport and supply units.

(*i.*) The six Divisional Transport and Supply Parks carry between them three days' supplies for the whole force. Each park, therefore, carries that amount for a proportion of the Cavalry Division and Army Troops, in addition to the supplies for its own division.

(*ii.*) The normal organisation provides two Advanced Depôts for the Field Force.

* From the above it will be seen that the fighting troops of the field army when subsisting entirely on supplies carried in transport and supply columns and parks are restricted to a radius of three and a half days from the advanced depôt, which must itself move forward to allow the advance of the force to be continuous. This is on the assumption that mechanical transport sections of the transport and supply park can march twice the distance of horsed transport daily.

this series? The second question, How is it to be connected up with the field ambulances and clearing hospitals? And thirdly, What means exist for the care of the sick and wounded in process of evacuation?

In answer to the first question, we find that a divisional transport and supply column consisting of three companies, Army Service Corps, has fifty-six general service wagons for carrying supplies. A divisional transport and supply park has seventy-eight general service wagons for supplies in No. 1 Section, and twenty-six 4-ton trucks for supplies in No. 2 and in No. 3 Sections.

The second line transport of an infantry battalion has four general service wagons. Each general service wagon is calculated to hold two patients lying down, without stretchers, or six patients sitting up with their arms and accoutrements, to which may be added two cases able to walk and ride in the wagon by turns. Three patients may be carried lying down if their injuries permit of it, two with their heads one way, the third with his head the opposite way.

As regard forming a connection between the field ambulances and the clearing hospital: as the empty wagons of the transport and supply columns are the first means for evacuation, it is one of the duties of the Administrative Medical Officer of the division to consult with the Assistant Quartermaster-General, or the Senior Transport Officer, as to the location of the "head" of that column with regard to the requirements of the wounded.

Recognising that when hostilities are not taking place supply considerations will have preference: on the approach of hostilities the Medical Service would represent that the requirements of the wounded should be given full consideration, and that arrangements should be made that as many empty wagons, of the transport and supply column, as possible, be collected at some suitable place; or it might be agreed beforehand that the transport and supply column, after emptying into the second line transport, be sent, wherever required, to collect the wounded from the field ambulances.

The next consideration must be the removal of the wounded, from possibly scattered dressing stations, to the head of the transport and supply column.

The empty supply wagons of the regiments, which have been unloaded for the issue of rations at night, go back to the column, generally daily, to refill. These, however, cannot always be relied on as available for carrying wounded, for, at the time when evacua-

tion of the dressing stations should commence, they may be still loaded and halted, or may be on their way up to the troops to unload. They should not, however, be lost sight of as a possible source of sick transport, and where such can be arranged, as many as possible should be sent to the dressing stations when empty. But for the removal of the wounded to the head of the transport and supply column, chief reliance must be placed upon the ambulance wagons of the medical units themselves.

In many cases it should have been possible to indicate over night the place to which dressing stations will send their wounded, for the purpose of meeting the transport and supply column or other transport.

This "preliminary concentration," as it might be termed, would perhaps be facilitated if a tent subdivision, or more, of a field ambulance were detailed to the head of the transport and supply column to receive and care for the wounded sent back from the dressing stations. All wounded having been brought in from the dressing stations, in ambulance wagons or on stretchers, to this point of concentration, the next step will be to load them on to the empty wagons assembled there. The field ambulance *personnel* should meantime have collected straw, mattresses, &c., with which to prepare the empty wagons, and should also have supplies of medical comforts ready for the wounded to take with them on their journey.

All men able to sit up should be got away, and as many men as are able to walk should be allotted to wagons to march alongside, taking turns to ride in the vehicles. Lying-down cases, if able to bear transport to the clearing hospital, should also be sent off in as large numbers as circumstances permit. It may be possible to delay the movement backwards of the transport and supply column until next morning, so as to give the wounded a night's rest and also to ensure all outlying cases being brought in.

In considering what *personnel* will be available for the care of the wounded during evacuation, we note that attached to a divisional transport and supply column are one officer and four rank and file of the Royal Army Medical Corps, and to a divisional transport and supply park, one officer and two rank and file of the Royal Army Medical Corps.

Where circumstances render it impossible to utilise advanced detachments of a clearing hospital, a large convoy would require additional *personnel* from the field ambulances, not only for the professional care of the sick but for their attendance and the

preparation of their food. It should seldom be necessary that this additional *personnel* should have to go further than the "tail" of the transport and supply column, otherwise the field medical units will be reduced in efficiency.

The clearing hospital, which will usually be near the tail of the transport and supply park, should be able to send forward detachments to take care of the wounded when they arrive at the "head" of the park, or when they are transferred from one section of the park to another. These detachments would have food and medical comforts prepared for the wounded, and, if necessary, buildings taken over and arranged for their reception for the night; the detachments would remain within touch of the field ambulances in front and the clearing hospital in rear.

The subsequent removal of the wounded from the clearing hospital is a problem which should not be as difficult as their removal from field ambulances, as, if the advanced depôt is not on a line of rail, auxiliary transport companies move between it and rail-head, and here auxiliary ambulance transport might well be utilised for the carriage of serious cases. Once rail-head is reached, ambulance trains and empty supply trains provide means for evacuation.

The removal of wounded from the cavalry division and the mounted brigades requires some further explanation. The divisional transport and supply parks, in addition to carrying supplies for the divisions, also carry supplies for the cavalry division and the mounted brigades, neither of these formations possessing transport and supply parks of their own. They have, however, transport and supply columns which connect up with the transport and supply park of the nearest division, or, if they are to be supplied from a base of their own, they are provided with a specially organised transport and supply park. The evacuation of their wounded will, therefore, be on the same lines as for divisions, except that the transport and supply column will either empty into the nearest divisional transport and supply park, or into its own specially organised park.

Army troops are in the same position as regards their supplies and their evacuation.

A Cavalry Division transport and supply column consists of 5 companies, Army Service Corps, and has 65 General Service wagons for supplies, while a Mounted Brigade transport and supply column has 15, and an Army Troops transport and supply column 17 General Service wagons for supplies. A Cavalry Regiment has 6 General Service wagons in its second line transport.

Such being the general system of removal of wounded from the field, it would be well to know what are the possibilites and what are the limitations of the medical establishments and Army transport with a division, in regard to the removal of its wounded. Before a wounded man leaves a field ambulance *en route* for the line of communication, his injuries must have been seen to. What, then, is the relation of the Medical Establishment in the collecting zone to the work to be done in tending the wounded?

Medical officers who have seen much active service in charge of regiments say that the time that can be given to a wounded man by a medical officer in that capacity depends on what sort of fighting is going on. From medical units, however, more definite information can be obtained, and during the Russo-Japanese War the number of patients which could be attended to by a medical officer, as they were brought into dressing stations, was checked several times, and was found to be almost constantly 7 or 8 per hour. For the purpose of calculation, six wounded men might be taken as the average number which can be attended to by a medical officer, in a field ambulance, per hour.

A division, the strength of which is about 20,000 officers and men, has 53 officers of the medical service, of whom 3 are administrative officers, and 3 are quartermasters, leaving 47 executive medical officers, and of these 27 are in the field ambulances. These 27 medical officers, at six patients per hour each, could attend to 182, or say 200 patients an hour, while the 47 medical officers of the division could attend to 282, or say 300 wounded per hour.

A division with 5 per cent. of casualties will probably have 200 killed and 800 wounded. The field ambulance officers could deal with the 800 wounded in four hours, or 1,000 wounded in five hours, or, if the regimental medical officers were included, the 1,000 wounded in three and a third hours, but as the final preparation of patients for evacuation will take place in the field ambulances, the duties of the regimental medical officers would seldom permit of their being available for this purpose. Twenty-five per cent. of casualties in a division would mean 1,000 killed and 4,000 wounded; these the field ambulances would take twenty hours to attend to before removal to the rear.

As a clearing hospital has only seven executive officers it could hardly be called on to spare any to assist in the field, and its officers would be fully occupied receiving and passing on the wounded.

These calculations are, of course, purely conjectural, questions

of time in relation to the surgery of injuries being extremely varying, and the number of hours required for dealing with a given number of cases obviously depending on the ratio of medical officers to wounded at any particular spot. A more definite subject is the relation of the existing transport in the collecting zone to the work to be done in removing the wounded.

Taking the hypothetical case of a division with 1,000 wounded, and no auxiliary sick transport to assist it, depending therefore on its ambulance wagons to collect its wounded, and on its transport and supply column to carry them towards the clearing hospital, the position appears to be as follows :—

Of 1,000 wounded, about 200 should be able to walk, say, five miles ; while the transport has probably come up to within $2\frac{1}{2}$ miles of the field, for the purpose of taking up wounded. The 200 cases able to walk should be able to get to the place where the transport is collected, without assistance.

Assuming that the ambulance wagons have to travel on an average $2\frac{1}{2}$ miles each journey, they should do easily three journeys (15 miles including return journeys), or five if necessary (25 miles).

There will be about 600 cases to be carried sitting-up, and there are 30 ambulance wagons in the division; 17 ambulance wagons, taking twelve each, will carry all in three journeys to the head of the transport and supply column. There will also be, say, 150 lying-down cases taking the remaining twelve ambulance wagons at three journeys, thus requiring all the 30 for these wounded. In addition, there will probably be 50 cases requiring special transport, these would need 25 stretcher squads at two journeys each, *i.e.*, one bearer division, and say, one bearer sub-division. Thus, all could be brought to the head of the transport and supply column, but their subsequent removal by divisional transport alone presents some difficulties.

The 600 wounded needing sitting-up accommodation would take 50 of the 56 general service wagons at two journeys, while to the remaining six wagons 100 of the 200 walking cases could be allotted, 16 to 17 to a wagon, riding by turns, the other 100 being detailed to the 50 wagons for the sitting-up cases, to ride and walk by turns. Thus, if all the 56 supply wagons of the transport and supply column were available, all the slighter cases could be removed at two journeys (*i.e.*, in two days), to the head of the transport and supply park where the 78 supply wagons of No. 1 Section could take the whole 800 at two journeys, sitting up.

The removal of the 50 very severely wounded cases would

depend on their condition, and the means available. For the 150 lying-down cases, and 50 cases requiring special transport, no divisional transport would be available until the third day (working on this basis), then, if about 100 of the lying-down cases can go three to a wagon, 34 of the wagons will take them, leaving 25 wagons required for the other 50 at two each, a total of 59 wagons, or, say, the 56 wagons of the transport and supply column at one journey. Thus a division, unassisted by special transport, appears to require three days to remove 1,000 casualties.

The number of casualties which unaided divisional transport is able to deal with at one journey represents a loss in killed and wounded of $2\frac{1}{5}$ per cent. of the total strength of a division; $2\frac{1}{5}$ per cent. equals 440 killed and wounded. Of these 88, or say 90, would be killed and 350 wounded. These 350 wounded could be attended to by the field ambulances in one and three-quarter hours, and, except for serious cases, removed by the transport and supply column at one journey, if all the 56 wagons were empty; 210 would require sitting-up accommodation, equal to 35 general service wagons at six to a wagon; 70 could walk with occasional rests in a wagon, and two such cases could be allotted to each of the 35 wagons carrying the sitting-up cases; 52, or say 54, would need lying-down accommodation, and if two-thirds of them, or say 36, could go three to a wagon, they would occupy twelve wagons, leaving nine more for the remaining 18 at two to a wagon, all the 56 general service wagons being occupied.

In No. 1 Section of the transport and supply park all the sitting and walking cases could be accommodated in 47 of the 78 supply wagons, the 54 lying-down cases occupying the remainder, but there would still remain of the 350 wounded about 16 seriously injured cases unfit to be moved by ordinary transport.

NOTES ON THE FEVERS PREVALENT AT FEROZEPORE IN THE PUNJAB, INDIA.

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Having been in charge of the Station Hospital at Ferozepore from October, 1904, to May, 1907, I became more or less conversant with the fevers prevalent there among the British troops, and venture to state some facts and make a few remarks thereon.

Enteric Fever.

In Table I. are tabulated the admissions and deaths from enteric fever by months for the years 1887 to 1906. It shows 297 cases and 117 deaths, giving a case mortality of nearly 40 per cent. What is the explanation of such high case mortality? There seems to be only one explanation, namely, a very large number of cases of enteric fever must have been overlooked, or at least not returned. If 20 per cent. be accepted as an average case mortality then half of the actual cases were overlooked, and precautions against spread by contact, &c., were not taken. The table also shows the tendency of this fever to epidemics, beginning in April and continued into May. Allowing ten days as an average incubation period, then a third of the cases admitted in May were probably contracted in April, and a third of those admitted in June were contracted in May. (It would scarcely be justifiable to add many of April's admissions to March). Thus, April would be saddled with about ninety-five cases and May with sixty cases.

Now, it may be asked, why this tendency to epidemics in April? The annual reports of the Hospital throw little light on this point. January and February are the cold months, often with several degrees of frost at night. March and April may be viewed as the spring months, when all vegetable life becomes active; but this does not help us much if the *Bacillus typhosus*, according to the recent dicta of bacteriologists, has not much of a saprophytic life outside the human body. Flies begin to become numerous towards the end of March and are perhaps most numerous in April, disappearing in May. They are again in evidence in the autumn, from about September to November, but not to the same extent. The hot weather begins in April, and there are perhaps oftener high winds and more dust in this month than any other; also sore throats and

gastric troubles are more in evidence than at any other time of the year. Whether flies or dust have anything or everything to do with this epidemic tendency I am unable to say.

The drinking water for the troops has been boiled from June, 1897, to the present date. Now the number of admissions during the nine preceding years was 136 (127·5 per 1,000) with 51 deaths, and during the nine succeeding 156 (159·2 per 1,000) with 64 deaths. I may here mention that the number of cases of dysentery during these two periods was 113 and 133 respectively—so the boiling of the drinking water reduced neither the number of cases of enteric fever nor of dysentery. These two facts make one wonder whether the expenditure on wood or charcoal recommended monthly for boiling the drinking water is sheer waste or not. However, there is the consolation that things otherwise might have been worse. Contact infection does not explain this epidemic tendency in April, for the three preceding months show fewest admissions for this disease, consequently there ought to be fewer ambulatory cases about than at any other time of the year. To what extent an epidemic is kept up by contact infection is another question, but the fact that the incidence of this fever among officers is greater than among N.C.O.'s and men tends to disprove that contact is the important factor in its spread. Besides the probability of many cases having been overlooked, and no precautions taken against contact infection must formerly have given this mode of infection a free hand, and one might well have expected a greater and continued prevalence.

The two small epidemics that began in May and April of 1905 and 1906 respectively did not seem in anyway due to contact, as most of the early cases came from different barracks and bungalows, and had little connection with each other; also in 1906 some of the married families suffered, which still further precluded contact as the cause.

There was no Government dairy at Ferozepore, but each of the British units had a dairy of its own run by a native under the supervision of a N.C.O. or private. Nevertheless, samples of milk taken by surprise at regimental institutes or from the dairyman's man while delivering milk were more frequently than not found to have been tampered with—separated milk must have come from the dairy itself, and the apparatus must have been in evidence surely—the milk seldom had the percentage of cream of a sample taken from the dairy itself. This showed that the supervision was imperfect and that the dairy supplies could not be excluded as a possible source of infection. I have often seen in reports on

TABLE I.—ADMISSIONS AND DEATHS FROM ENTERIC FEVER AT FEROZEPORE BY MONTHS FOR THE YEARS 1887 TO 1906.

Years	Jan.		Feb.		March		April		May		June		July		Aug.		Sept.		Oct.		Nov.		Dec.		Totals		Admissions per 1,000
	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	A.	D.	
1887	..	..	..	..	1	..	1	..	2	1	..	..	..	..	..	..	1	..	..	..	..	..	..	..	5	1	4·9
1888	..	..	..	..	..	..	1	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	1	1	3	2	3·05
1889	..	..	..	..	1	..	13	5	14	3	4	2	2	..	..	..	1	..	1	..	..	..	1	1	37	11	32·5
1890	2	1	1	1	..	..	3	..	..	1	..	..	3	..	5	3	6	3	3	1	..	..	..	..	23	10	22·3
1891	..	..	1	..	1	..	2	..	..	..	3	1	1	1	1	..	..	..	..	..	..	..	..	..	9	2	9·0
1892	..	..	..	..	1	..	4	1	2	2	1	..	1	..	..	..	..	..	2	2	2	1	..	1	13	7	13·5
1893	..	..	..	..	..	..	..	..	1	1	4	..	1	1	3	1	3	1	..	..	2	..	..	1	14	5	13·3
1894	..	..	..	..	..	..	3	1	3	..	2	1	..	1	2	1	1	1	5	1	3	..	..	1	19	7	17·2
1895	..	..	..	..	..	..	4	1	5	3	1	1	..	..	..	..	..	..	..	..	..	..	..	..	10	5	9·3
1896	..	..	..	..	..	..	3	..	..	1	..	..	..	..	..	..	1	..	..	..	3	..	1	1	8	2	7·4
1897	..	..	1	..	..	..	3	..	1	..	*	..	..	..	..	..	1	..	2	..	..	..	4	1	12	1	12·1
1898	..	..	..	..	1	1	8	2	11	7	2	5	..	..	1	..	3	2	..	..	2	..	1	2	29	19	33·7
1899	..	..	..	..	1	..	5	1	12	8	1	1	1	1	1	1	..	..	..	..	..	..	2	..	23	12	25·0
1900	2	2	..	..	..	..	2	2	..	..	..	..	..	..	1	1	..	..	1	..	..	1	1	..	7	6	8·9
1901	..	1	1	..	..	..	4	1	7	4	3	2	5	3	2	1	..	1	1	..	..	1	..	..	23	14	22·1
1902	..	..	..	..	1	..	2	1	1	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	4	4·5
1903	1	1	..	..	..	..	..	..	1	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	4	1	4·6
1904	..	..	..	..	..	..	4	..	2	3	1	..	1	..	..	..	..	..	1	..	..	1	..	..	9	4	10·7
1905	2	..	3	..	1	..	..	..	5	..	3	..	1	..	2	1	..	..	2	..	..	..	1	..	18	1	20·2
1906	1	..	..	..	..	..	7	1	10	1	..	..	1	..	1	1	..	..	2	..	..	..	5	..	27	3	29·5
—	8	5	7	1	8	1	69	16	78	39	25	13	18	7	19	10	18	8	18	4	12	4	17	9	297	117	—

* Water boiled (and pinked) from this date (June, 1897).

epidemics of enteric fever the remark "that the dairy supplies were beyond suspicion," and wondered if samples taken by surprise supported this remark, and whether dairymen at other stations were less enterprising than those at Ferozepore.

Malarial Fevers.

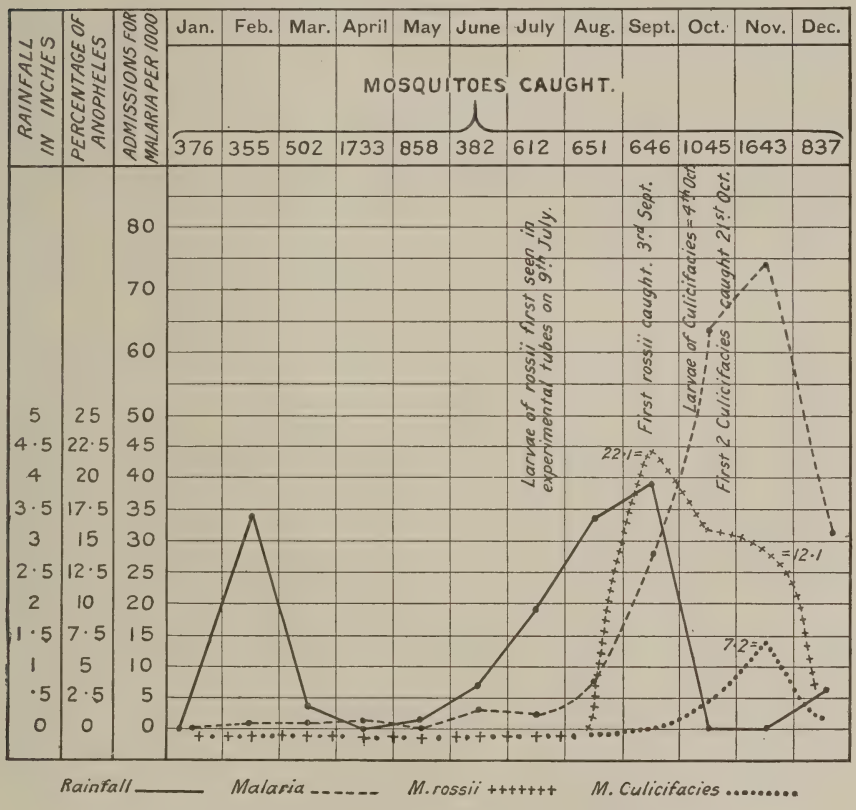
In Table II. are shown the rainfall and the admissions for malaria for the years 1896 to 1906. Before inviting attention to some deductions that may be drawn from this table, I desire to point out that the returns for simple continued fever vary so much from year to year (presumably with the personal equation of the medical officers responsible) that care must be taken lest wrong conclusions be arrived at. The table, however, shows the wet months to be July, August, and September; October and November are the driest and the most malarious months. I must here mention that there are no regular monsoon rains in Ferozepore, and that the rainfall of a month, especially in the hot season, is generally the result of a series of thunderstorms spread over a couple of days or so.

As a general rule the wettest years are seen to be the most malarious, *e.g.*, 1900, and the malarial rise reaches its maximum a month or two after a heavy fall and is only noticed in the second half of the year. What the table shows constantly and persistently is that after a malarious autumn the *admissions* continue through December into next year, but in diminishing numbers irrespective of rainfall, as an aftermath as it were. Thus compare the early months of 1901 and 1902 following the malarious autumn months of 1900 and 1901 with the early months of 1906 following the non-malarious autumn of 1905. This aftermath probably consists chiefly of relapses and perhaps of a few latent attacks, as presumably no infections take place then, for no anopheles mosquitoes are actively in evidence at this time of the year.

During 1905 some 7,000 mosquitoes were caught, chiefly in the men's barrack-rooms and hospital. Amongst these (with the exception of a doubtful *M. listonii* caught in the hospital in January, and a few *N. stephensi* caught in a bungalow in May) was only one *M. rossii*, caught in September, although from September to December the larvæ of *M. rossii* were observed in a great many pools of water. Apparently few of these reached the imago stage, owing to the larvacidal measures employed. No culicifacies larvæ were found in the cantonment, though plentiful

in a canal a mile or so distant from the nearest barracks. The autumn prevalence of malaria was scarcely noticeable (see Table II., 1905).

The diagram appended represents the events of 1906. The rainfall was somewhat greater than in 1905. A fall of 3·4 inches in February was followed by no anopheles among the mosquitoes



Curve Diagram of Rainfall, Mosquitoes and Malaria for 1906.

and by no malaria rise, but a fall of 3·3 inches in August and one of 3·8 inches in September was followed by a considerable percentage of anopheles among the mosquitoes caught and by an increase in admissions for malaria. It will be noted that the malaria rise corresponds more to the rossi curve than to that of culicifacies. It is true that the maximum of the malaria curve corresponds with the maximum of the culicifacies curve that is in

November, but the admissions in November were swelled by a good number of relapses, otherwise it would have been below the October height. There is another fact which supports the suspicion that rossi has something to do with the cause of malaria in this station. The British troops are stationed in the fort and in the cantonment proper, which are some two miles apart. Now no culicifacies were caught in the cantonment proper, nor were any of their larvæ found there, whereas rossii and their larvæ were numerous alike in both places. It was estimated that seventy-nine initial infections occurred in the cantonment proper, sixty-six in the fort, seventeen at outside stations, and there were thirty relapses. Similar larvacidal measures were undertaken during both these years, and it is not clear why they failed in 1906 and were apparently so successful in 1905. During 1906, 9,640 mosquitoes were caught (♂ = 5,021, ♀ = 4,619); of these 598 were *M. rossi* (♂ = 288, ♀ = 310) and 151 were *M. culicifacies* (♂ = 70, ♀ = 81), also a few *N. fuliginosus*, *N. stephensi* and *C. pulcherrima*.

Of the 83 cases returned in 1905, the benign tertian parasite was found in 50, the malignant in 17 and non-differentiated (parasite not found) in 29. Of the 187 cases in 1906 the benign tertian was found in 50, the malignant in 72 and non-differentiated in 65. The fever in the non-differentiated cases, about a third of the whole, was diagnosed malaria by the clinical symptoms aided by the effect of quinine treatment. The large number of non-differentiated cases was no doubt to a certain extent due to the prophylactic administration of quinine which was given to the troops on the commencement of the malarial season, as well as to the want of time for more prolonged search for the parasite in the blood. Probably a large majority of the non-differentiated cases were of the benign tertian type, for in nearly all of these cases the blood, after the subsidence of the attack of fever, was searched for crescents, but none were found. That crescents may be expected in the blood after an attack of the malignant type is shown by the fact that they were found in 70 of the 72 cases in 1906, and in the two cases in which they were not found it was seen, on referring to the laboratory notes, that the cases had been diagnosed malignant tertian on the strength of a few doubtful malignant rings. The appearance of crescents in the blood was usually found to be as follows: After a primary attack, whether the case was treated with quinine by the mouth or by intramuscular injections, they began to appear about the fifth to the seventh day after the

TABLE II.—RAINFALL IN INCHES AND ADMISSIONS FOR MALARIA AT FEROZEPORE, FOR THE YEARS 1896 TO 1906.

		Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total	Per 1,000
1896	Rain ..	·60	·64	·05	..	·51	·80	·97	·53	·04	·31	·04	·03	4·50	
	Malaria	13	18	33	17	18	84	64	22	20	10	11	10	320	295·5
1897	Rain ..	1·54	·34	·09	1·10	1·29	1·32	1·59	2·54	·46	..	..	·54	10·81	
	Malaria	..	..	..	..	..	..	..	..	..	..	..	..	843	840·5
1898	Rain ..	·45	4·38	..	·26	1·00	1·59	7·21	·07	1·60	..	..	·40	16·96	
	Malaria	74	41	40	82	55	26	54	93	55	97	37	10	664	777·0
1899	Rain ..	..	·43	..	·12	..	·93	·23	2·40	..	0·3	..	..	3·75	
	Malaria	7	5	9	26	41	31	108	42	74	75	25	22	465	505·5
1900	Rain ..	·40	·80	·23	·95	·76	·87	3·77	6·51	13·69	·17	..	·58	28·73	
	Malaria	22	7	11	11	4	19	30	78	129	399	385	236	1,331	1,485·5
1901	Rain ..	·75	·62	·52	·64	·75	·35	4·21	1·10	..	..	..	..	8·94	
	Malaria	70	15	22	39	84	73	57	168	78	144	132	69	951	914·4
1902	Rain ..	..	..	·25	·04	·37	2·83	3·45	4·98	·51	·35	..	..	12·78	
	Malaria	38	38	41	39	33	22	47	80	47	83	126	42	636	731·4
1903	Rain ..	·43	..	2·30	..	·52	..	9·48	2·28	1·74	·23	..	..	16·98	
	Malaria	22	21	11	13	23	24	28	32	33	113	111	49	480	555·5
1904	Rain ..	1·17	·01	1·23	..	..	·59	·41	·75	·81	..	·23	..	5·20	
	Malaria	36	19	23	29	27	23	34	23	19	18	27	6	284	340·1
1905	Rain ..	1·83	·25	0·4	..	·03	·55	3·33	..	3·50	..	..	·23	9·76	
	Malaria	4	4	8	11	6	2	6	6	8	12	13	3	83	92·9
1906	Rain ..	..	3·41	·44	..	·12	·69	1·91	3·38	3·88	..	..	·66	14·49	
	Malaria	..	1	2	2	1	2	2	5	20	62	59	31	187	204·1
Total	Rain ..	7·17	10·88	5·15	3·35	5·45	10·32	36·66	24·54	26·23	0 99	0·27	2·44	..	..
	Malaria	286	168	200	269	292	306	438	551	483	1,013	926	478	..	..
Per 1,000 ..		265	171	178	276	342	371	519	706	626	1,238	1,019	523	..	..

subsidence of the attack; their numbers would go on increasing for a week or so, remain more or less stationary for a while, and then disappear more or less gradually, though in some cases they would persist for a month or two, in spite of any treatment I have tried. A mode of treatment successful in driving these gametes from the blood is a great desideratum with regard to prevention. One feels obliged to keep these cases in hospital under mosquito curtains until the crescents disappear or until the cold weather comes and the anopheles cease to prey.

The success claimed for injections of perchloride of mercury in a life phase of the *T. gambiensis* in sleeping sickness suggests a trial here. In an attack of fever the presence of crescents in the blood along with parasites (ring form, &c.) in the corpuscles indicates that the attack is not a recent one, *i.e.*, has lasted a week at least off and on, or that it is a relapse. But I hasten to add that relapses have been observed to cause the crescents to disappear from the blood apparently completely, and they always seem to diminish their number, only again to appear or increase after the attack has subsided. Gametes of the benign tertian do not seem to persist in the blood after an attack treated with quinine. Below is given in tabular form the type of fever in the epidemic months of 1906.

August			September			October			November			December		
N.D.	B.T.	M.T.	N.D.	B.T.	M.T.	N.D.	B.T.	M.T.	N.D.	B.T.	M.T.	N.D.	B.T.	M.T.
3	1	1	9	11	0	20	19	22	21	8	30	6	9	16
4		1	20		0	39		22	29		30	15		16

The total shows that the benign type is predominant at the commencement of the malarial season and the malignant proportion increases as the season goes on. Probably the reason of this is that quinine is more effective against the benign than the malignant parasite; also it may be that the malignant parasite is more of a cold season parasite.

I may here add that the microscope was used for diagnostic purposes in all cases treated in hospital, but no attempt was made to diagnose cases by the increase of large mononuclears or by the presence of malarial pigment.

I fully recognise that owing to the number of non-differentiated cases of malaria in the years 1905 and 1906, some discount must

be made from any value that may be placed on some of the facts recorded with regard to that disease and to simple continued fever, but claim that an honest endeavour was made to avoid error in diagnosis.

Simple Continued Fever (or Heat Fever or Three Days' Fever of Rogers).

Table III. shows the admissions for simple continued fever for the years 1887 to 1906. It is not complete, but nevertheless it shows at a glance a very great variation in the number of cases from year to year, namely, from 398 in 1889 to none in 1904. Such a great variation, it seems to me, can only be accounted for by the varying views of the medical officers concerned in making the returns, or by the epidemic nature of the disease. The table, even in its incomplete state, shows that it is mainly a hot weather fever (the hot weather in the Punjab officially begins on April 15th and ends on October 15th).

Now, what is the nature of the fever or fevers returned under heading of "Simple Continued Fever"? Being more or less responsible for the diagnosis and return of most of the 302 cases in 1905 and 1906, I saw a good deal of them; leaving out a small number of cases which probably could be counted on the fingers of one's hands, and for which no definite cause or disease could be assigned, most of the patients returned under this heading on presenting themselves complained of having been ill for a short time, seldom longer than twelve to twenty-four hours, many for a shorter period. All complained of more or less headache, usually general, though sometimes frontal, sometimes occipital, with pains in the back. Headache was the first thing felt by the patient, sometimes accompanied by an admitted feeling of chilliness, seldom by a definite rigor. Thirst, anorexia and a dry, hot skin were other prominent symptoms. The temperature varied from about 101° F. to 105° F., 103° and 104° being common; the pulse rate varied with the temperature and was somewhat throbbing when that was high. The treatment usually consisted of a purge (of 3 grains of calomel, with or followed by a dose of white mixture), diaphoretic mixture and, if the temperature was high, cold sponging or wet pack. The blood in nearly all the cases was searched for malarial parasites and no quinine was given. Under this treatment the fever gradually subsided, so that the temperature would reach normal usually on the third day, some cases on the second day, in

hospital. The temperature used to fall with a continuous slope down to normal (though this slope might be disguised by the cold sponging or wet pack), and this is the most characteristic feature of this fever. In a certain number of cases this slope was interrupted by the evening temperature on the second day being no lower or a little higher than that in the morning. Patients were generally discharged after five to seven days in hospital. There were practically no relapses, though a man might occasionally come in again with a second attack.

Table III.—Admissions for Simple Continued Fever at Ferozepore, for the Years 1887 to 1906.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
1887	..	..	5	33	25	17	46	35	38	36	10	4	249
1888	2	1	10	38	50	33	42	61	35	1	..	..	273
1889	..	..	..	..	..	..	..	..	..	..	..	..	398
1890	..	..	..	..	..	..	..	..	..	..	..	..	356
1891	..	..	..	..	..	..	..	..	..	..	..	..	50
1892	..	..	..	..	..	..	..	..	..	..	..	..	91
1893	..	..	..	..	..	..	..	..	..	..	..	..	82
1894	..	..	..	..	..	..	..	..	..	..	..	..	12
1895	..	..	..	7	4	13	1	2	..	..	4	..	31
1896	..	..	1	2	1	..	..	..	..	..	..	..	4
1897	..	..	..	..	..	..	..	..	..	..	..	..	33
1898	2	1	2	25	20	20	9	7	6	1	1	..	94
1899	..	1	6	8	7	1	7	2	2	1	1	3	39
1900	1	..	..	2	1	2	7	..	..	..	..	..	13
1901	..	..	4	1	3	1	2	2	..	..	..	..	13
1902	..	..	..	1	7	4	6	3	..	..	..	..	21
1903	..	..	..	..	1	..	1	..	1	..	..	..	3
1904	..	..	..	..	..	..	..	..	..	..	..	..	0
1905	1	..	3	3	17	30	30	12	19	2	2	1	120
1906	..	..	..	24	34	30	46	37	9	1	1	..	182
Totals	6	3	31	144	170	151	197	161	110	42	19	8	—

Ætiology.—The one constant condition present when these cases of fever occurred was an uncomfortable degree of heat, so this fever used to be designated "heat fever." A continued number of oppressive days and nights used to increase the number of admissions. The opposite condition, *i.e.*, the coolness following a fall of rain, would stop the admissions and hasten the recovery of those in hospital with this fever, often in a remarkable way.

Some cases seemed to be caused by exposure to the sun, which might account for cases occurring after the hot weather; some were associated with drinking bouts, and I have seen a few second admissions in such patients. Perhaps constipation, over-

eating, and other indiscretions predispose to this fever; but heat, uncomfortable heat, seems the main factor in its production.

How the heat produces the fever is, of course, a difficult question. It may be by simply upsetting the thermotaxic centres in some way or other. There is little or nothing to suggest that a strange microbe has an immediate hand in its production. There are some reasons for the suspicion that most, if not all, the heat-strokes that occur during the hot weather are due to an exacerbation, or rather a hyperpyrexia, of this fever. Some cases admitted to hospital for what was apparently heat fever have suddenly passed into heat-stroke. Heat-strokes seem to be most numerous when heat fevers are prevalent, and most patients, on recovery from heat-strokes, admitted having felt ill before the attack. Should this suspicion turn out to be correct this fever will assume a greater importance than it at present occupies, for in the Punjab after enteric fever more deaths result from heat-stroke than from any other disease.

I desire to add that in collecting the above facts, which are to a certain extent a summary of parts of the annual reports for 1905 and 1906, I owe much to the staff of the Station Hospital, more especially to Senior Assistant Surgeon Orman for the capture and enumeration of the mosquitoes.

ON SURFACE VACCINATION IN SUSPECTED CASES OF TUBERCLE.

By Major S. L. CUMMINS.
Royal Army Medical Corps.

The method of surface vaccination with tuberculin introduced by von Pirquet, and suggested as a test for the presence of tuberculosis in cases where ordinary clinical and microscopic methods have failed to give certain information, has been tried at the Royal Victoria Hospital, Netley, and the results obtained form the subject of this paper.

Twenty-one vaccinations were carried out at the request of medical officers in charge of cases. In these a preparation of Messrs. Allen and Hanbury, consisting of 25 per cent. solution of Koch's "Old" Tuberculin, enclosed in sterile glass capsules, was used. Eleven vaccinations were also carried out for experimental purposes, six being in known tubercular subjects (diagnosed by microscopical examination of the sputum) and five in patients suffering from various minor maladies, but in whom there was no trace of tubercular disease. In these latter test cases, solutions of tuberculin of two strengths were used as follows :—

(1) Koch's "old" tuberculin, 25 per cent. in normal saline solution, to which 10 per cent. glycerine had been added.

(2) "Old" tuberculin, 5 per cent. in glycerine and saline as above.

In all cases, a "control" vaccination with sterile normal saline solution was carried out, to make certain that the "reaction" was not merely traumatic. The degree of reaction was recorded on a chart, in a manner similar to that employed by Dr. Alfred Wolff-Eisner and explained in his book "The Ophthalmic and Cutaneous Diagnosis of Tuberculosis."

The technique employed was as follows :—

The vaccinations were carried out with sterile glass needles, made by drawing out glass-tubing into pipettes, and after softening in the flame by again drawing out the limb of the pipette and breaking off the fine point. Such needles have the advantage that they are sterilised in the making, and being hollow, retain a small quantity of fluid in the point. Fresh needles were made for each vaccination, and thrown away after use. The site chosen was a point about an inch below the insertion of the deltoid on the upper arm, where a bandage is easily retained in position. A drop of the

fluid, large enough to cover a surface the size of a threepenny piece, was placed upon the skin, the arm being held horizontal. Through the fluid twelve pricks with the pin were then made.

A "control" vaccination with sterile saline was made on the opposite arm, an equal number of pricks being made. The saline vaccination was made first, the same needle being used subsequently for the "tuberculin." This is important, as, were a different needle used, the degree of traumatism might be greater with a blunter needle. The "saline" vaccination must be done first, as the needle would retain enough tuberculin to give rise to a reaction in the "control" arm, if the order were reversed. The skin of both arms must be rendered aseptic before the vaccination, and the vaccinated point must subsequently be protected from rubbing, as this would increase the reaction.

Local Reaction.—(1) A raised area of infiltration appears at the site of vaccination, being quite recognisable, in most cases, within about six hours. Some pain is usually experienced. The infiltrated area enlarges during two or three days, and may go on to vesiculation. This, however, only occurred in two of my cases.

(2) As a rule there is an area of *redness* which is more extensive than the infiltrated area. A red blush often shows *at once* on vaccination. This preliminary blush is purely traumatic, and disappears in an hour or two. It is well seen on several charts.

The reaction blush comes on at about the same time as the infiltration. I am unable to say whether it is of great significance, but I am inclined to think that it is less important than the infiltration, upon the severity of which, taken with the cutaneous sensibility of the patient, it probably depends.

Method of "Charting" the Reaction.—The diameter of the area of infiltration and of redness respectively is measured by laying a piece of clean paper across them and marking the edges with a pencil. The measurement is then transferred to a chart. The edge of the infiltrated patch is best appreciated by touch, as to the eye it appears to blur off into the redness.

The diameters of each area are recorded by measuring upwards from the "normal" line of a temperature chart, the height from this line being marked by a black dot for the infiltration and a white dot for the redness. Observations were made every two hours on the first day to ascertain the actual time of onset; and twice daily on subsequent days. The morning and evening readings only for the "first day" are shown on the charts appended, but the reaction was usually visible within six hours, as compared with the "control."

The charts give an inadequate conception of the reaction, as they give no idea of the elevation of the infiltration, nor much index of its intensity, but they are of value for purposes of comparison.

Analysis of Charts.—Of the twenty-one cases in which the test was applied as a clinical measure, some were certainly tubercular, and others were not so. They may be divided as follows :—

Cases certainly Tubercular.—Charts 1, 4, 8, 9, 10, 13, 14, 16.

Cases probably Tubercular.—Charts 2, 11, 15, 17, 18, 20, 21.

Doubtful Cases.—Charts 3, 5, 12, 19, and 7.

This classification is made on clinical grounds, quite apart from the results on the charts.

It will be seen that three charts are practically negative, Nos. 7, 12, and 21. It would have been natural to expect a larger number of negative charts amongst the "doubtful cases" perhaps; but on the whole, a positive reaction was not surprising in any of the cases, and was to be expected in most of them. So far as they went the results appeared to point to the test being a good one. It was not, however, possible to say from these cases whether the test was usually negative in non-tubercular cases. By kind permission of the officer in charge, I was enabled to carry out the experiment shown in charts "A" to "F," and "R" to "V."

Six known tubercular cases, and five patients free from tuberculosis, as far as could be ascertained, were tested in a precisely similar manner, two strengths of tuberculin being used to make the probability of *negative* reaction greater.

It will be seen that four out of the five non-tubercular cases reacted, and the reactions were more severe than the known tubercular cases. That a quantitative element enters into the matter will be apparent on noting that the reaction to 25 per cent. tuberculin was, in every case, greater than that to 5 per cent.

Conclusions from Experiments.—It will be obvious on examining the charts that the great majority of cases react, though great variety is manifest in the degree of reaction; this variety being more obvious when actual cases are compared than when the charts only are examined. This variety in response, taken with the entire absence of reaction in some cases, demonstrates that some element other than "irritation" is involved. This element must be a property of the patient, as the vaccination is made with a "constant" fluid, and under constant conditions.

Dr. Wolff-Eisner's view is that the reaction if positive, proves previous "contact" with tubercle bacilli, even though remote. It is well known that a large proportion of all bodies examined

show traces of tubercular disease, old or recent, on *post-mortem* examination; and, further, there must be a number of bodies in which such disease has existed, although no trace can now be found.

Modern investigation puts "tubercle-contact" at a figure quite high enough to explain the large number of positive reactions observed in healthy persons.

While this justifies the theoretical basis of "surface vaccination," it takes away greatly from its utility as an adjunct to clinical methods. The practical point at issue in diagnosis is the presence, or absence, of active tubercular disease. I find "surface vaccination" quite unreliable as a means of answering this question.

—●—●— Area of infiltration, measured from "normal" line.
-o---o---o- Area of redness, measured from "normal" line.

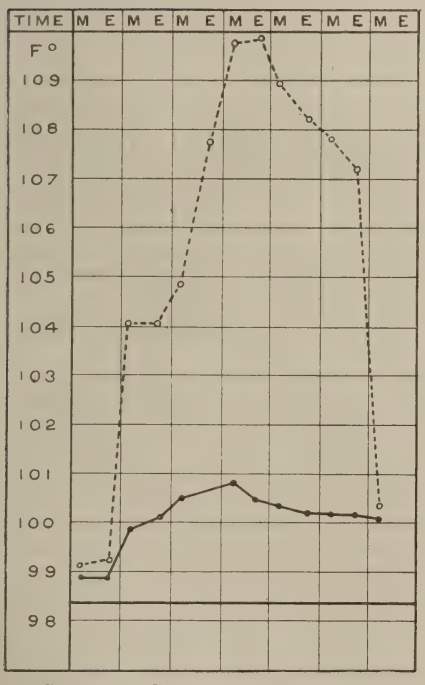


CHART 1.—Case of suspected tubercle of knee-joint.

CHART 2.—Chronic bronchitis; loss of weight; no T.B. found in sputum. Cytological examination is not in favour of tubercle.

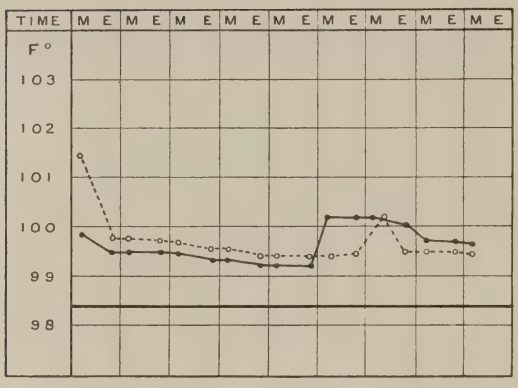


CHART 3.—Chronic malarial patient, who suffers from cough, and is losing weight. No T.B. found in sputum. This chart seems to represent Wolff-Eisner's "Late Reaction."

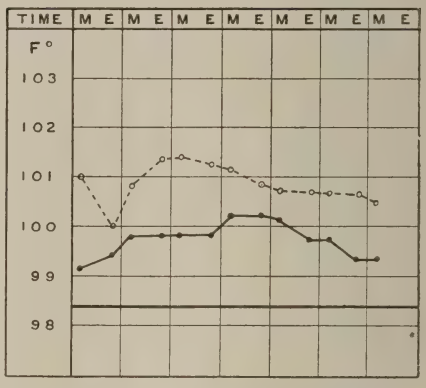


CHART 4.—Advanced disease of elbow-joint, undoubtedly tubercular; had been operated upon. Joint healed well, but there remained some ankylosis, and a painful point—query, active tubercle.

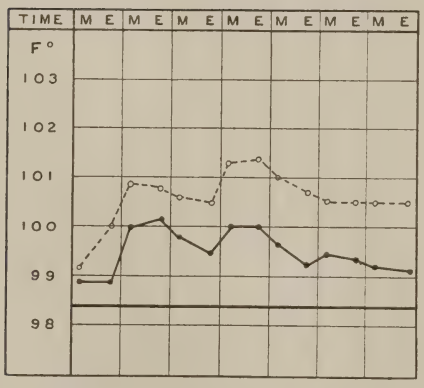


CHART 5.—Cystitis. Patient cachectic. Frequent examination of deposit fails to show any T.B., but case suspected to be tubercle of bladder.

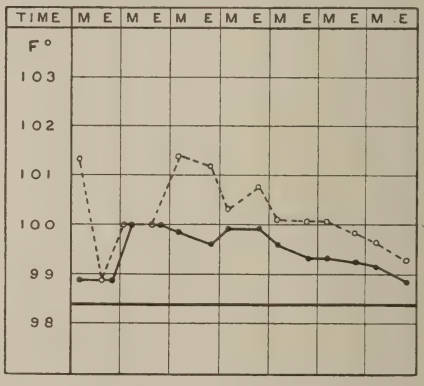


CHART 6.—Chronic synovitis of ankle-joint. No signs of tubercle elsewhere.

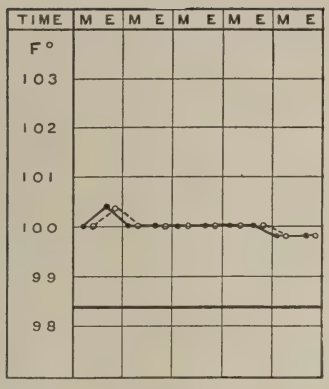


CHART 7.—Originally diagnosed as hip-joint disease, but has rapidly improved at Netley. No shortening; mobility good; general condition very good.

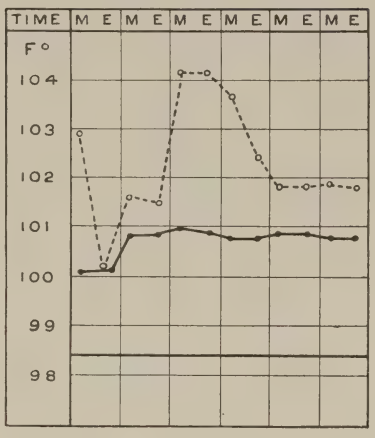


CHART 8.—Tubercle of Lung diagnosed microscopically abroad. Is now apparently greatly improved, and clinical signs slight or *nil*. (?) Active tuberculosis.

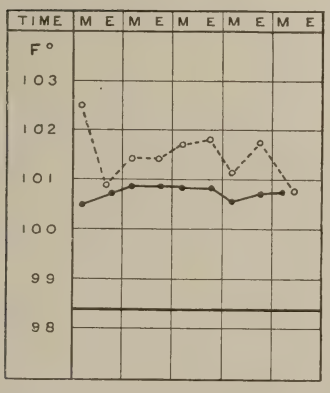


CHART 9.—Disease diagnosed as tuberculosis in India. T.B. found at that time, but not here. Very fit, and clinical signs almost *nil*. (?) Active tubercle.

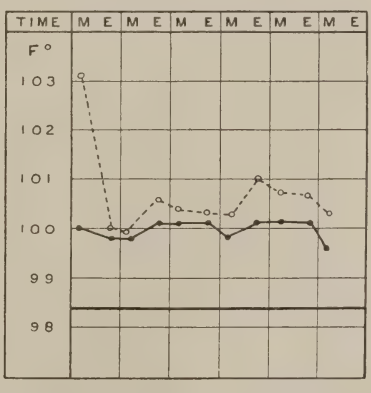


CHART 10.—Disease diagnosed as tuberculosis in India, T.B. being found. Is now very fit. No clinical signs. T.B. not found on examination. Reaction inconclusive.

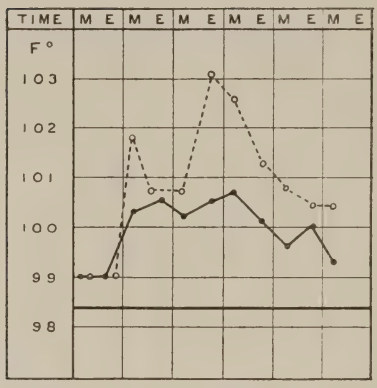


CHART 11.—Old hip-joint disease now greatly improved. Query tubercle.

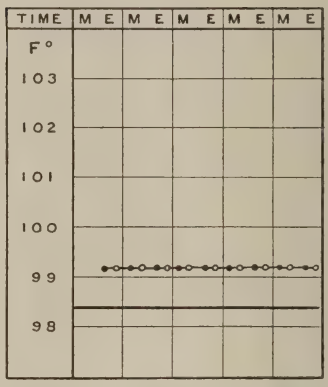


CHART 12.—Empyema, chronic. Repeated examinations of both discharge and sputum show no T.B., but both abroad and at Netley pneumococcus has been found. Wasting and hectic temperature.

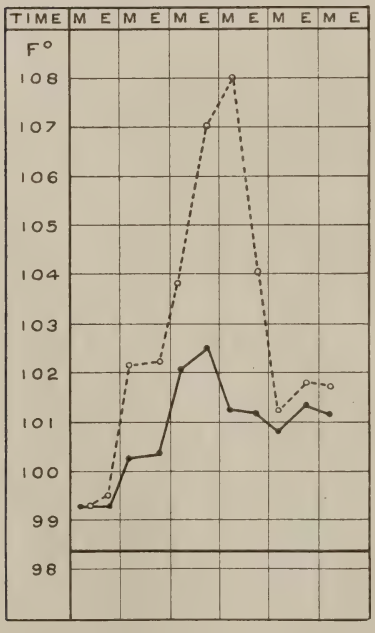


CHART 13.—Clinically, this case is a typically tubercular affection of epididymis of both testicles.

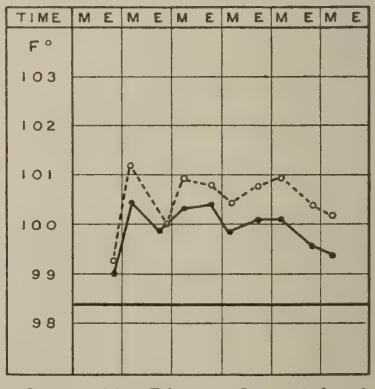


CHART 14.—Diagnosed as tubercle abroad. No clinical signs at present.

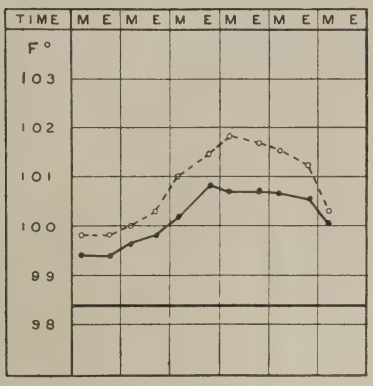


CHART 15.—Hip-joint disease, thought to be tubercular.

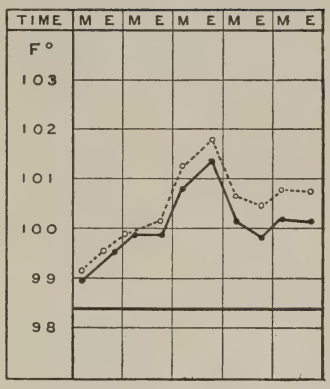


CHART 16.—Perforation of tympanic membrane, with suppuration in middle ear, thought possibly tubercular. Tubercle bacilli subsequently found in sputum, but not in discharge.

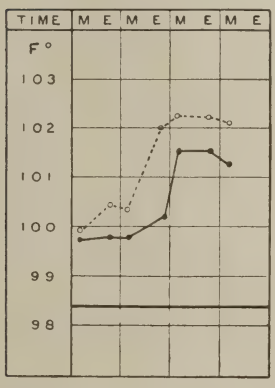


CHART 17. — Inflamed lymph-glands and affection of hip joint. Invalided to Millbank before reaction was complete.

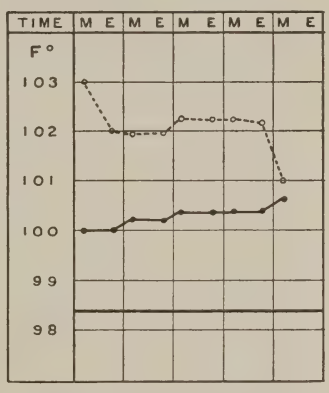


CHART 18.—Hip-joint disease, believed to be tubercular.

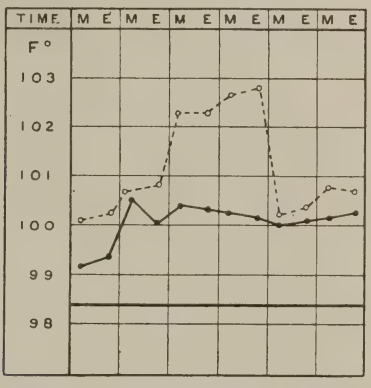


CHART 19.—Lateral curvature of spine. Suspected tuberculosis, but not much clinical ground for this.

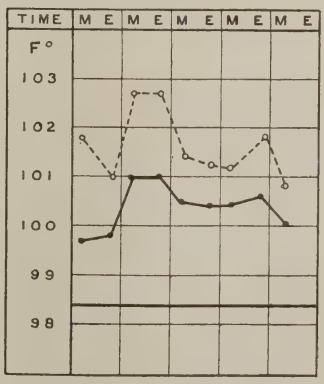


CHART 20.—Contusion, left ankle, with subsequent disease of bone.

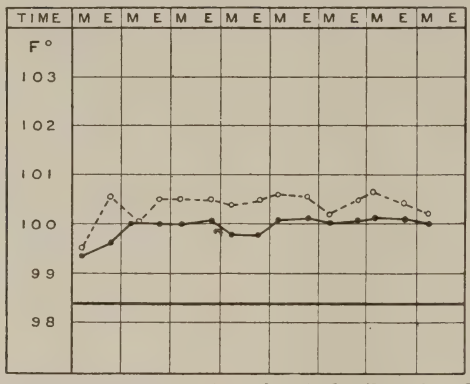


CHART 21.—Psoas abscess. No tubercle bacillus found in pus. Patient now nearly quite fit.

EXPERIMENTAL SERIES. *KNOWN* TUBERCULAR CASES.
Charts A *to* F.

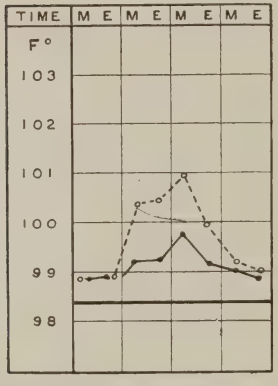


CHART A.—Tuberculin 5 per cent.

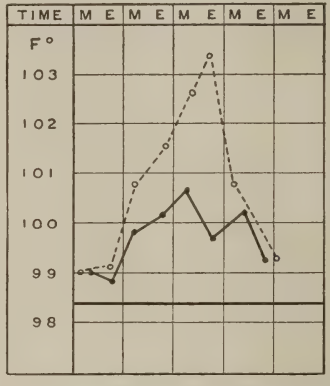


CHART A.—Tuberculin 25 per cent.

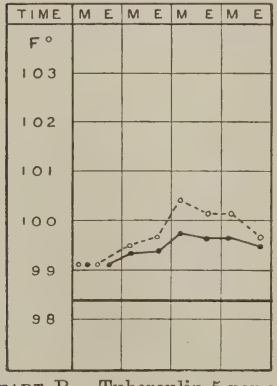


CHART B.—Tuberculin 5 per cent.

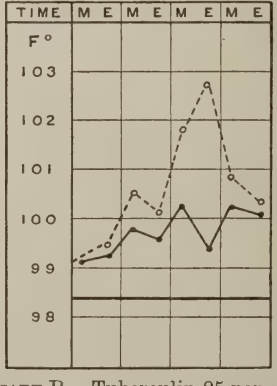


CHART B.—Tuberculin 25 per cent.

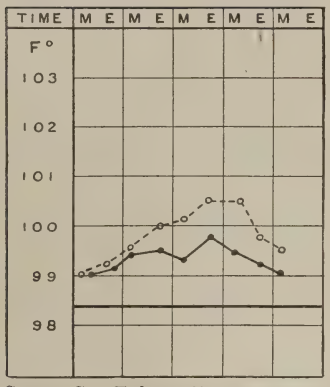


CHART C.—Tuberculin 5 per cent.

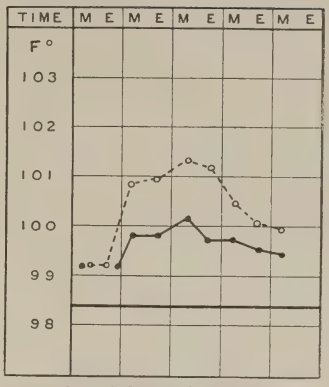


CHART C.—Tuberculin 25 per cent.

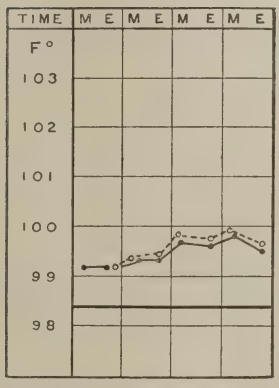


CHART D.—Tuberculin 5 per cent.

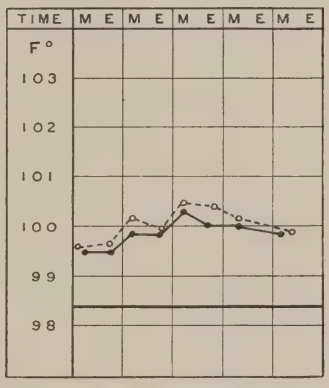


CHART D.—Tuberculin 25 per cent.

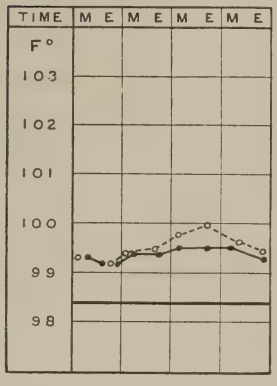


CHART E.—Tuberculin 5 per cent.

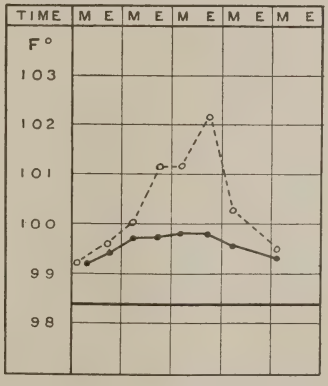


CHART E.—Tuberculin 25 per cent.

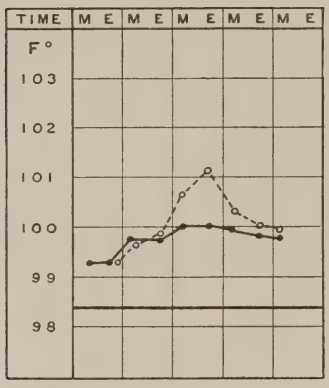


CHART F.—Tuberculin 5 per cent.

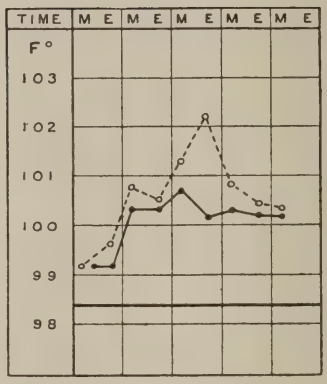


CHART F.—Tuberculin 25 per cent.

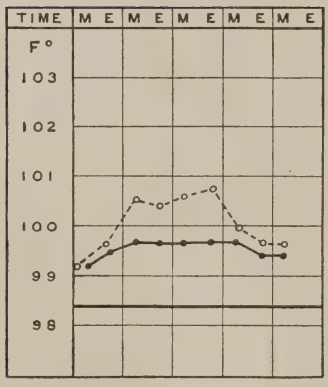


CHART R.—Tuberculin 5 per cent.

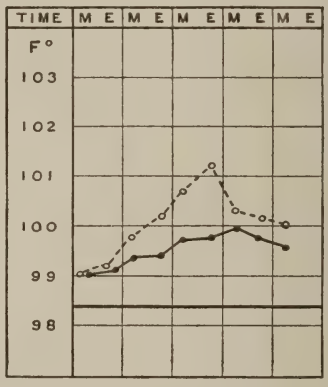


CHART R.—Tuberculin 25 per cent.

Disease.—Internal piles. A man of fair physique. No signs of tubercle. Family stated to be healthy.

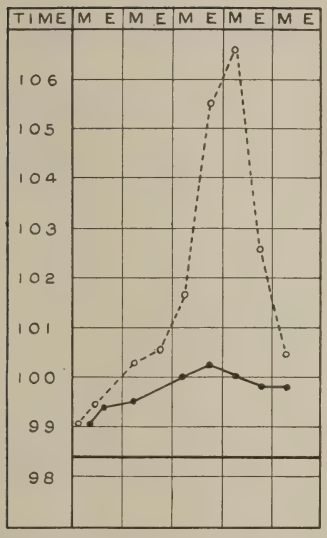


CHART S.—Tuberculin 5 per cent.

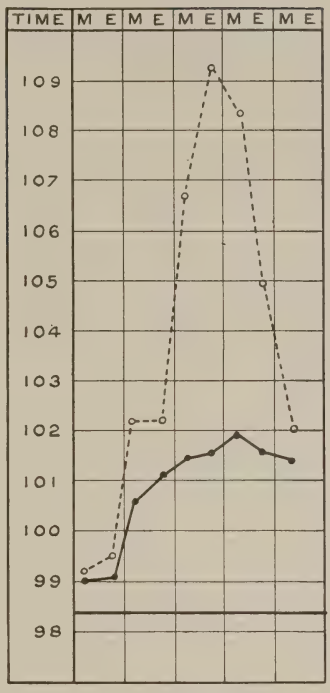


CHART S.—Tuberculin 25 per cent.

Disease.—Dislocation of right wrist, now nearly well. No signs of tubercle can be found. Family history good.

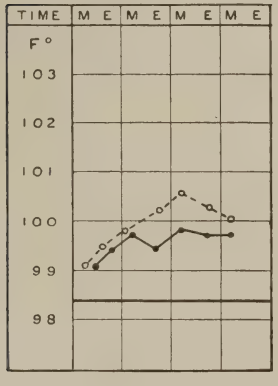


CHART T.—Tuberculin 5 per cent.

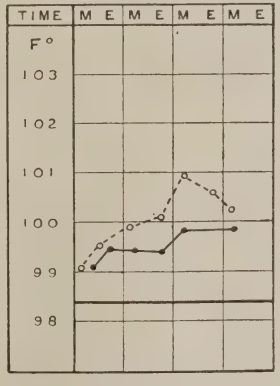


CHART T.—Tuberculin 25 per cent.

Disease.—Dislocated cartilage left knee, now much improved. Good physique. No signs of tubercle. History good.

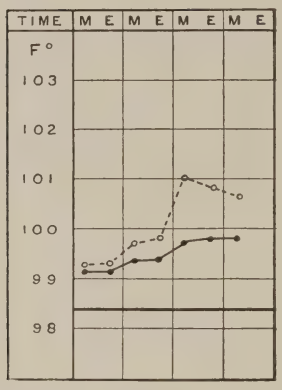


CHART U.—Tuberculin 5 per cent.

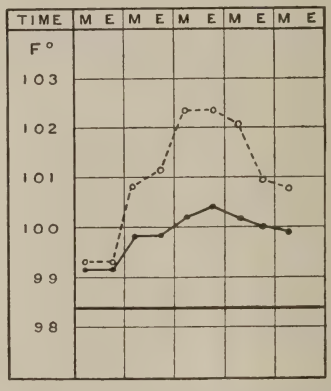


CHART U.—Tuberculin 25 per cent.

No suspicion of tubercular disease.

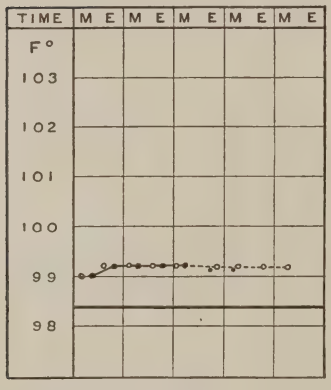


CHART V.—Tuberculin 5 per cent.

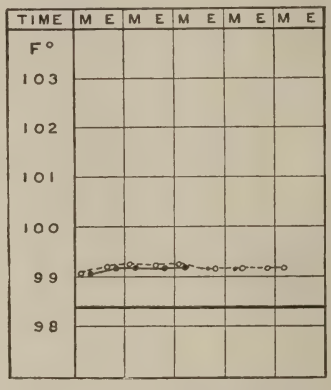


CHART V.—Tuberculin 25 per cent.

Disease.—Inflammation of connective tissue, right ankle, result of an injury. Much improved. A very fine man with no trace of tubercle, and good family history.

HINTS ON CAMPING ARRANGEMENTS FOR SANITARY OFFICERS.

By Captain R. TILBURY BROWN.

Royal Army Medical Corps.

(*Continued from p.* 553.)

PART II.

Points for Consideration and Arrangements to be Made before Arrival of Troops.

(1) *Infectious Diseases.*—Make enquiries from the local medical officer of health as to the prevalence of any infectious disease in the vicinity of the camp.

Arrange with the authorities of an infectious hospital for the reception of infectious cases from the camp. Ascertain the hospital charges, and obtain the sanction of the Principal Medical Officer for infectious cases to be transferred there.

(2) Through the administrative medical officer issue *definite instructions* as to the making of latrines, urinals, &c.; an explanatory sheet of drawings should accompany the orders to each unit. These instructions should be applicable to all the camps. They should be communicated to the sanitary N.C.O.'s of units before they accompany the advance parties. For specimen of orders see Part IV.

(3) Through the administrative medical officer order the sanitary N.C.O. and men of each unit to accompany the advance party, and to be employed on sanitary duties alone. The sanitary N.C.O. should always accompany the advance party, but the number of sanitary men may vary. For instance, if a previous camp is being evacuated, some of the sanitary squad must be left behind to clear up and assist the fatigue parties. I suggest that four should go with the advance party and four be left behind. On the other hand, when leaving barracks, &c., it might be possible to send all the sanitary squad in advance.

(4) *Milk Supply.*—During the first two or three days in camp tinned milk should be used, and during that time the sanitary officer should obtain from officers commanding units the addresses of the proposed contractors, and satisfy himself that the condition of the cows, method of milking, washing of cans, &c., is satisfactory. Until this has been done, and a notification has been sent to the officer commanding troops, the contractor should not be permitted

to make contracts for the supply of the troops. Notice to this effect should be given and a request for information as to addresses should be made.

(5) *Communicate with the Officer Commanding Royal Engineers* of the camp or camps, and ascertain whether :—

(*a*) Proper latrine seats have been provided for officers and N.C.O.'s (see Part IV.).

(*b*) Wells have been protected from surface pollution.

Wells must be covered and protected from the entrance of surface water. This applies to all wells, whether they are pumped and attended to only by the Royal Engineers or used directly by fatigue parties.

Figs. 10 and 11 show two methods of protecting wells.

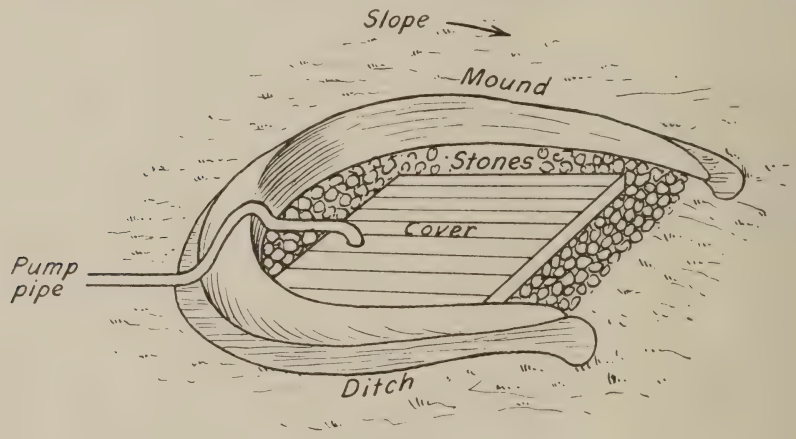


Fig. 10.

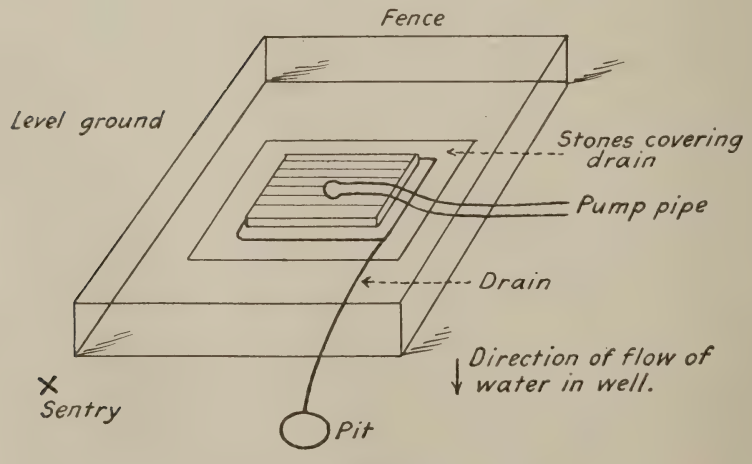
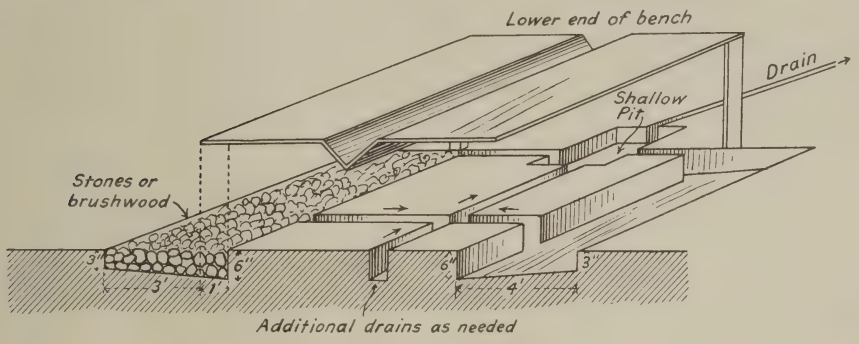


Fig. 11.

If an existing well is being used it will frequently be found to be unsteined, and an efficient coping is rarely present. In all cases make a shallow drain close to the well leading to a soakage pit on the downward side and well away from the well; then cover the surrounding ground with stones, gravel, or brushwood.

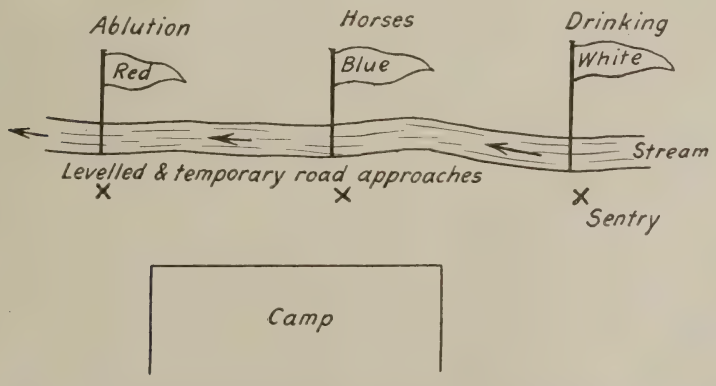
(*c*) The spring head has been prepared (see Part I.).

(*d*) Proper ablution benches have been erected.



V-shaped Ablution Bench.

Do not use the ordinary grating bench, which has many disadvantages and greatly increases the difficulties of sanitation in camp, but try to get the V-shaped ablution bench. If benches are not available use lengths of canvas supported on upright posts,



but remember that if canvas has contained soapy water it cannot subsequently be used for watering horses. If no appliances are available, water taken directly from a stream or river will probably have to be used. Mark the appointed place by flags before the troops arrive. Ablution must be performed down stream from

the camp and the place marked by a red flag; animals must be watered up-stream, and the place marked by a blue flag; if drinking water is obtained from the same source it is taken still further up-stream and the site marked by a white flag. The approaches at these places are levelled, covered with rough stones, or a temporary road is made.

(*e*) The arrangements suggested for disposal of waste water have been made. If they cannot be made before troops arrive, have a few pits dug for temporary use on arrival, and apply to the General Officer commanding the camp for a sufficient number of men on the morning after arrival to make the necessary arrangements.

(6) *Water Squads.*—Ascertain from the administrative medical officer what arrangements have been made for water squads (Royal Army Medical Corps), and what water carts or filter carts are to be provided. If wooden or metal carts are to be used, instructions for cleaning them should always be given. Information on these points will generally appear in brigade orders some time before the camp is occupied.

(7) Ascertain that the tenant of an institute has asked the officer commanding Royal Engineers to point out where he may dig latrines for temporary use. This must be done immediately he arrives in camp. He must also at once make arrangements with the local contractor for the supply of a refuse barrel and for the disposal of its contents. He must not allow refuse to accumulate, but must burn all that is not removed by a contractor.

(8) The sanitary officer should visit the camp the day before occupation and see that it is ready.

(9) If boiling, clarification, or filtration of water is necessary, see that the materials required are ready before the troops arrive.

Duties of the Sanitary Squad.

The squad, or a portion of it, will accompany the advance party and will make: (1) *Latrines:* A row for one day must be dug for officers, for N.C.O.'s and for men. (2) *Urinals:* One for officers, one for N.C.O.'s, and one for men. (3) *Urine Pit:* One is required to receive the contents of the night urine tubs if they are used. (4) The necessary pits or drains for the disposal of waste water. (5) *Greasy water straining pit:* One for each cookhouse, one for officers' mess, and one for N.C.O.'s mess. (6) *Incinerator:* One for the camp. The squad will also prepare the ground under drinking water stand pipes and around ablution benches.

In the absence of a sanitary squad this work must be performed by the pioneers, under supervision of the officer in charge of the advance party.

PART III.

In Camp.

Refuse.—The refuse of a camp consists of: (*a*) General rubbish about tents; (*b*) kitchen garbage; and (*c*) refuse from coffee shops and institutes.

The general refuse may conveniently be collected in sacks, which are hung on posts at the end of the lines of tents, and men should be ordered to place any rubbish in these sacks. Kitchen garbage is usually collected in barrels or tubs, which should be placed on raised stands close to the cookhouses; these stands may be made by four short posts supporting a rough wood framework. Tenants of coffee shops and institutes must also arrange with local contractors for refuse barrels.

As regards disposal: If the camp is for only a short occupation burn all refuse in camp incinerators. If, however, the camp is to be occupied for a long time it is usual to contract for removal of kitchen garbage, as it has a commercial value, but it can quite easily be disposed of in incinerators if these are properly constructed and attended to by trained men.

If removal is by contract, stipulate that barrels or tubs are present the day before troops arrive, that the removal is by carts which will not allow spillage of their contents, that removal is daily and, if the camp is large, that removal is to be carried out at definite times. Refuse must be taken at least half a mile from the camp. All refuse other than garbage should be burnt. Indestructible refuse, *e.g.*, empty tins, should be passed through the incinerator and then buried.

Water Supply.—Sentries should be placed at wells and springs, and at the appointed places on the banks of a river. Patrols should guard a stream or river for some distance beyond a camp. Water parties should go at stated times and should always be accompanied by an officer. The captain and subaltern for the day from each battalion should visit the various watering places; the field officer on duty and orderly medical officer should also pay surprise visits. The approaches should be roughly paved and cleared of bushes.

When obtaining water from a river with high banks, or even from pools, use a pump and not buckets; the hose should have

a perforated ball and be placed in a sunken barrel or box. The water should be pumped into tarpaulin sheets, where mud can settle before the water is further treated. Rough filtration may be improvised by digging a shallow well close to the pool or stream. If water from wells is to be used for ablution, convey it by a pipe to the ablution place.

Washing of Cooking Utensils. — This is a matter of some difficulty, and unless suitable arrangements are made there is considerable fouling of the ground and insanitary methods of cleansing are employed.

"Washing-up" is required at (*a*) messes, and (*b*) after the men's dinner.

At the officers' and serjeants' messes there must be an appointed place, and a table or boxes, with a straining pit handy, clean cloths, and a plentiful supply of clean water must be provided.

At the men's messes the following arrangements are used and found satisfactory: A washing-up tent is provided, the water being boiled in special stoves, and the washing up is done by permanent special orderlies, whose work is supervised by a N.C.O.

For the washing-up by individual men a bench is required, and it should not be far from a supply of boiling water. A V-shaped ablution bench would answer the purpose, but the ends should be blocked up, the lower one having a hole fitted with a plug attached to the bench by a cord. The V acts as a trough diminishing the waste of water. The waste water must pass through a grease trap before entering a drain or pit. If ashes are used they should be collected and kept in boxes near the benches, and it should be the duty of one of the *sanitary squad* to see that the supply is present, that boiling water and soda are obtainable, and he should be in attendance at washing-up hour.

Clothes Washing.—The ablution bench can be used and the V-shaped bench is particularly good, as the ends can be blocked to form a trough which will diminish waste.

Clothes Drying.—In very wet weather some means of drying may have to be improvised, *e.g.*, a marquee fitted with posts and ropes, buckets with holes in them to act as braziers, the tent being tightly closed.

Food Supplies.—These should be inspected as regards quantity and quality, and facilities should be given the men to obtain beer with their meals and not just before it; otherwise men returning from a march are apt to take beer in large quantities and are not inclined to eat their meals later.

Coffee Shops and Institutes.—These places require special attention. Each must have its refuse tub and washing place with grease trap. The employees, and also grooms, should be regularly inspected by the medical officer for itch and infectious diseases, &c.

Hawkers.—The General Officer commanding the camp should be asked to issue strict orders that no hawkers are to be allowed in camp or its vicinity, and the men should be warned of the danger of buying drinks or food from them.

Tents.—Tents should be opened up all day, and men should be advised to sleep with the door open. The tents should be struck once a week in fine weather, and the ground swept and exposed to air and sun. In wet weather it will be necessary to dig trenches round the tents, and drains should be made to carry away surface water; this should be done early. The maximum number of men allowed to sleep in a tent should be twelve.

Bedding should be opened out and aired daily at hours fixed by company officers.

Duties of the Sanitary Squad.

As already stated, the chief duties are making latrines and urinals, working the incinerator, placing and emptying urine tubs, cleaning the grease strainers, supervising ablution and washing-up benches and cleaning the camp.

The sanitary N.C.O. should tell off the men to their various duties, supervise their work, and report to the quartermaster when difficulties arise.

At Reveille.—Two men should see that urine tubs are emptied into the pit, that fresh earth is put into it, that the tubs are filled with water, and that the stands are whitewashed and fresh earth is placed on them.

Half an Hour after Reveille.—Two men should overhaul and clean out the incinerator and bury tins and ashes in a special pit. The remaining men should clean up camp generally, including washhouses and latrines. The N.C.O. should then inspect the ground in the vicinity of the institutes and report to the quartermaster any dirt or rubbish not properly disposed of.

After Breakast.—One man is placed in charge of the incinerator, and one man at the officers' latrines. One man cleans and refills the straining pit at the officers' and serjeants' messes and at the cookhouse; in the evening, and oftener if necessary, he performs the same work, and puts fresh earth into the soakage pit. One man is placed in charge of the ablution and washing benches. The

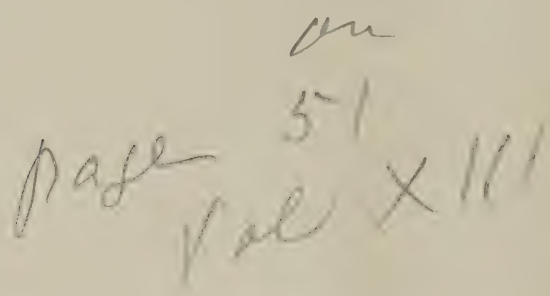
remaining men of the squad dig serjeants' and men's latrines, also urinal trenches as required, and put fresh earth in the pit of the urinal every third day.

Two men are told off every night to place urine tubs outside the wet canteen, &c., to light lamps for the same, and to place lamps in serjeants' and men's latrines. The same men empty urine tubs at 9.30 p.m.

If contractors are employed to remove excreta or refuse, the sanitary N.C.O. must be present while the removal is being carried out.

The roster is changed weekly with the exception of the man at the officers' latrine, who is permanently posted there, but does his other sanitary work as well.

(*To be continued.*)



United Services Medical Society.

PHYSICAL TRAINING AND THE MEDICAL PROFESSION.

By Surgeon K. D. BELL, R.N.

I do not propose to enter into a series of startling statistics on the physical degeneracy of the present day, or to play the part of the alarmist in quoting figures (often unreliable) dealing with the increase of mental and physical breakdown.

It is, however, a definite fact that we are passing through an epoch in the history of evolution, which is having a great effect on the mental and physical welfare of the people.

It is common knowledge that in the days of the Roman and Greek supremacy physical and mental development were absolutely co-ordinated in the education of each individual child. We read, however, in the history of our own nation how physical education was carefully attended to in the Middle Ages and games were indulged in by everybody; how it was the pride of each youth to belong to the yeomen class, and how training was carried out systematically by a *large* majority, bodily strength and fitness being the all-important factor, while the *mental* training was confined only to a few, the majority of the people being unable even to write their own names. This state of affairs has gradually been changing, the physical fitness of the people being neglected more and more as mental education spread to the masses, and selection by written examinations became the custom.

The *epoch* we are passing through to-day is one characterised by an ardent thirst for this mental development from early childhood from one generation to another, each successive child having an increased amount of strain put on his or her brain. Added to this we have the rush and hurry of modern civilisation as compared with the calm and collected state of affairs one hundred or even fifty years ago, when electricity had not given us the nerve-straining privilege of being rung up on the telephone from all parts of the country in a moment of time, when motor cars were not invented to whirl and rush the people about from one excitement to another, when business was conducted steadily and peacefully. Moreover, the strain of modern war, with all its scientific improvements, produces a far greater degree of nervous tension than used to be the case when men fought at close quarters and physical fitness gained the day.

This pressure of mental work is gradually destroying all that is natural and normal in the civilised races, and is making them highly strung, neurotic and delicate. With these ever-increasing intellectual and exciting elements have come the decrease of healthy physique and the development of a delicate and over-taxed organisation, which is forming one of the chief causes of the National degeneration of to-day, and is producing the weak-chested, nervous, and vicious inhabitants we see so commonly in every town.

Added to this we find another element is gaining a strong hold of the English race. This is the ever-increasing desire of specialising in our various sports. England has been for centuries the home of sport, and we take pride in the fact to-day that we are still a race of sportsmen. These fine old National sports have however, been gradually and steadily falling to the lot of a few who have trained themselves for one particular object, to which they confine themselves in order to break former records. A great crowd stands by and applauds the efforts of this or that "*survivor of the fittest,*" and the majority amongst this crowd have not, probably, played a game or taken part in that form of exercise for years.

This specialising in one or other kind of sport (though possibly a fine thing for the individual in more ways than physical health) is, I consider, one of the evils which is gradually depressing the all-round physique of the whole nation. If we were to go to war and had to call upon our men for normal feats of endurance, it is the ALL-ROUND physique we should want, not the man who says he cannot march so many miles or use a shovel because he is a hurdle racer, or the man who says he is unable to pull an oar, but that he could put the shot farther than any other man in the south of England.

This extraordinary freak development and varying physique was well shown amongst our athletes at the recent Olympic Games in the Stadium, where I had the privilege of being in attendance as an Hon. Medical Officer, and seized the opportunity of studying the types of the various nations.

For some time efforts have been made to ward off this pending evil, and men are giving up the whole of their time to the study and teaching of physical training. The subject is obviously one of burning importance to us in the Services, and it is a matter of almost daily occurrence to find an article in the morning papers dealing in one way or another with physical education, showing how the public mind is at last gradually and *steadily* turning in this direction.

It is equally a matter of grave importance that the subject has not attracted among medical men the attention which it deserves, owing no doubt, in great part, to the two reasons mentioned by Dr. Pembrey, of Guy's Hospital, in the most interesting paper he read before this Society on February 13th, 1908, in which he said that: "On the one hand the physiology of muscular work has not formed a special part of the teaching of the medical student; on the other hand, physical training or culture has been so frequently exploited for pecuniary gain by so-called *professors*, who have claimed for their methods the cure of almost every kind of disease, that the taint of quackery has clung to it."

The Admiralty has given me the opportunity of studying this question for the last three years by appointing me to the Physical Training School at Portsmouth in August, 1906; also, I have had the privilege of attending a year's course of instruction at the Central Gymnastic Institute at Stockholm last year.

My first step was to join up with a class of petty officers undergoing a course of three months' instruction at the Portsmouth school, in order to learn what they were being taught, and to feel the effects of the exercises on myself PERSONALLY, and thus to get as thorough a practical knowledge of the subject as I could before diving into theories or judging the work as a *spectator*, and not as a participator. I carried out the same idea during my visit to Stockholm, and took part in the daily routine of exercises and lectures given at the Institute with the seventy Swedish naval and military officers undergoing a course of instruction, so as to go as deeply as I could into the practice and effects of the movements of the human body.

It is on this PRACTICAL side of the question that I propose to speak to-day, as the short time at my disposal does not permit of my going into so large and extensive a field as the theoretical side, but I trust the opportunity may be given me to do so at some future date.

To start with, I should like to point out the vast difference there is between physical training as it is now beginning to be understood and the old types of gymnastics. We are all more or less familiar with the sight of a drill instructor turning circles on horizontal or parallel bars before a class in a gymnasium, and then one or two boys doing likewise, while the remainder attempt the exercise and fail *miserably*. This, of course, is absurd from many points of view; there is no kind of easy exercise for the weak boy to practise at, and so encourage him gradually to reach the standard of the more athletic boys of his age.

In the old type of gymnastics the object in view was the accomplishment of certain exercises or "acrobatic tricks," of no use to the general well-being afterwards, consisting as they did of a mere collection of exercises based on no order or principle. The majority of the exercises employed had as their aim and object the formation of big muscles, a practice which was carried out at the expense of everything else and particularly of the heart and lungs, causing the condition of emphysema, with dilated and irregular heart, which was not at all uncommon a few years back. One remembers seeing how the weaker members of a class were jeered at, and held up to ridicule, because they were unable to do the acrobatic feats which their more fortunate colleagues were capable of performing. This forced them to exert themselves beyond their strength, and to strain at lifting heavy weights, or to endeavour to pull themselves up ten or more times to a bar, with contorted bodies, breath forcibly held on inspiration, and signs of marked distress evident in the congestion of the venous circulation, due to the over-strain put on the right side of the heart.

Besides laying the foundation for future evils, this form of so-called training, at the best, produced muscle-bound and clumsy individuals who could only use their power in their own fixed ways, and were useless when called upon to bring into play certain co-ordinate and natural movements they had never exercised.

Again, it was the boy who was naturally strong enough to do a few tricks to start with that got all the attention of an instructor, who was forced by his position to produce a few pupils able to perform *pretty tricks* for a show to be given at the end of the term, or for a competition at Aldershot. These few (I suppose 10 per cent. would be a liberal allowance at the majority of schools) were already physically efficient and therefore did not require gymnastics. What happened to the remaining 90 per cent. who really required physical training? They spent at least seven-eighths of their time watching other people do fancy tricks and the remaining one-eighth *trying* to do exercises which were too hard for them.

The true object of physical training should be to increase the strength, agility, and power of endurance of our boys and men. By "strength" I do not mean muscle (as is so commonly understood), but an even balance of work between every organ and function of the body, striving to produce an all-round man. We must endeavour to build up the feeble to a good medium of health and strength; we should strive to diminish annually the number of social wasters which the modern conditions of life tend to increase.

Discretion and experience warn us of the error of acrobatic sights which pervert public spirit. The results of physical education lose their interest if, instead of benefiting the mass, they serve to form certain athletes to satisfy the vain curiosity of the crowd.

In the Services we need some such *daily* routine of exercise to keep the men fit and ready for any duty they may be called upon to do, without strain to their internal economy. This has been recognised, as you all know, for some years now in the Navy, and the School of Physical Training at Portsmouth turns out annually officers and men who have been trained to instruct the boys and older ratings on the lines of the Swedish system of gymnastics.

The internal machinery and the very careful attention to detail of this system is not a subject one can discuss in a few minutes, as it comprises the results of years of experience of men who have devoted their lives to the study of the cause and effects of the movements of which the human body is capable—the mechanics of the pull of muscles round the various articulations, the study of individuality, and a host of factors which necessarily must be taken into consideration in such a science. The amount of work put upon the heart throughout the period of physical training is carefully considered, and the daily exercises are so arranged as to regulate the action of the circulation in such a way as never to overwork one portion of the body at the expense of another.

The general principles of that part of the system we employ (viz., educational gymnastics) are arranged round three fundamental characteristics :—

(1) The nature and intention of the exercises.

(2) The progression of the exercises.

(3) The definite arrangement of the exercises in the daily lesson.

I propose to take separately, and yet *very* briefly, these three headings.

(1) *The Nature and Intention of the Exercises.*—Every gymnastic exercise (of this system) has a special physical effect embodied in it, which is chiefly dependent on the changes, produced in accordance with the laws of physiology, in the organs of locomotion taking part in the movement and in those parts of the nervous system which are called into play by it, and each exercise is practised solely to produce that effect. Hence the importance of insisting on and knowing the correct position, as this is essential to the exact determination of the physical effects.

(*a*) An exercise comprises three distinct parts :—

(i.) The attitude from which the movement starts—called the starting position.

(ii.) The points through which it passes.

(iii.) The final position at which it ceases.

Each one of these parts is definitely laid down in order that the exercise may produce the exact effect desired. There are some 900 to 1,000 distinct exercises described with their particular effects, and the combinations of these are almost infinite. The duty of the instructor is to select suitable exercises and combination of exercises for the particular class he has to instruct.

A large number of exercises, called "free standing exercises," are carried out without the use of any apparatus. However, as the pupils advance in the course, certain positions are obtained with the assistance of apparatus. The true value of this apparatus is to serve to support certain parts of the body so as to bring about modifications in the exercises which the laws of gravity would otherwise render impossible.

The apparatus is designed to admit of *large* numbers using it at the same moment, so preventing the loss of time which is the usual accompaniment of old forms of apparatus used in gymnasia. General training being a cardinal principle of the system, exercises are provided for every part of the body, and to produce many different and distinct effects so that in half an hour all parts of the body have been worked to a certain necessary degree, instead of working one set of muscles only all the time until they are tired out and neglecting the other parts of the body, as used to be the case in the majority of our older gymnastic schools.

The exercises of this system are further collected into "*groups*," according to their most pronounced physical effects.

Great attention is paid to the development of an *expansile* and *resilient* chest in the young and its maintenance throughout life, and to the fact that the breathing should be free at all times.

No exercise is applied for developing the muscle as such, so the overstrain often attending such attempts is avoided. The qualities aimed at in *this* direction are suppleness, co-ordination, smart innervation and agility.

(2) *The Progression of the Exercises.*—The exercises in each group are arranged in a perfectly graduated scale, from the simplest up to the most difficult. Each rung of the ladder (so to speak) being so blended into the one below and the one above it as to cause no appreciable difference at the moment. Each step varies in rate of progression according to the age and individual capabilities of the class under training. Thus in the very young the exercises

employed are the simplest, and a long time is spent over them before the more difficult forms of exercises are reached. This ensures the whole training being carried out without any strain or damage to the youth, and enables the harder exercises to be performed correctly and strongly because the elementary stages of positions have been thoroughly learned before hurrying on and blundering into the more difficult series. In other words, it means one must not expect the pupil to read and write before he has learned to form his letters correctly; or, again, one must not force a boy to take part in severe exercises or games, in which his strength is pitted against bigger and stronger boys, before he has been educated to know how to use his physical efforts for his good, and thus prevent his overdoing it, at the expense of his general health.

Another important element in this progression is to refrain from hurrying on the weaker members of the class in order to keep them up to the level of the one or two stronger youths. The standard should be that of the average, so that the class is kept back until the more unfortunate ones have attained the required efficiency in their exercises, rather than forcing or straining them to do what Nature has not made them physically capable of performing at once. By this means the body is gently strengthened to do such work which it was impossible to perform a few months ago owing to lack of suppleness and strength.

This progression must necessarily vary with the different types of physique met with. The individual characteristics of the batch of recruits have to be taken into consideration, whether town- or country-bred, or whether from colliery districts or some manufacturing centre. The climate and season of the year have all to be borne in mind, so that the would-be instructor of physical training has a large amount to study and make himself acquainted with all his life.

A very important factor also embodied in this progression, and one which will appeal strongly to anyone who has gone into the question of the training of the recruit, is that the so-called position of attention should be one which is gradually reached by careful training and not one which is insisted on at the first lesson, when it is bound to be accompanied by over-strain. This point has often been discussed at these meetings, and *particularly* in the admirable paper read at the Royal United Service Institution by Lieutenant-Colonel Davey, late of the Royal Army Medical Corps, on January 30th, 1907, headed, "The Blot in Recruit Training."

(3) *The Arrangement of the Exercise in the Daily Lesson.*— As a general development of the whole body is aimed at, every part of it must receive its due attention at each lesson and no part must be neglected. This system consequently exercises at every lesson as many as possible of the groups of muscles of the body, whose healthy action bears some importance to the health of the whole.

It has been found by experience that the efficiency of the exercises is increased if they are carried out in a certain definite order. The arrangement of the exercises in this definite order daily constitutes what is known as a "table of exercises." The order is based on the effects of the exercises, care being taken not to let several movements that have the same effect on the general economy follow each other, and thus prevent fatigue and strain. In a "table" the body is gradually worked up to an effort by isolated exercises at first, then by combined movements each having a special object in view which will assist in the performance of the heavier exercises to follow.

When a condition necessitating rapid tissue change has been reached and maintained for a short period, the table of exercises is so arranged as to gradually calm down the work put on the internal economy, thus, so to speak, applying the breaks gradually and smoothly instead of bringing the machinery up with a sudden jerk.

Another important fact taken into consideration is that when a group of muscles have been contracted for any period of time they are at once extended by the exercise which immediately follows, and in this way their full capacity for action is assured, which keeps them supple and expansile, instead of allowing them to remain shortened and fixed, as is often the result when their contraction is alone considered. Consequently, the groups of exercises comprise various flexions and extensions in rapid succession, which, beside being beneficial to the tone of the muscles and the range of movement in the articulations brought into play, have a marked stimulating effect on the general venous circulation, and materially relieve the work put on the heart.

The general arrangement of the tables employed in the School of Physical Training at Portsmouth is based on these and many other points, but time does not allow of my going any deeper into the question here this evening.

This is a *very* brief outline of the methods now being employed in our Naval and Military Physical Training Schools. The ideal

state of affairs is necessarily some way off, as such a work as this is can only be justified by its results in the future; but every year is bringing us nearer to the goal, and I feel confident (as far as one can with so short a study of the subject, and judging from the results already obtained) that this is the *soundest system* for the training of all-round physique that can be adopted by any nation.

This statement is founded on a study of the results of nearly one hundred years' training conducted on these lines in the Swedish army and navy, for which every facility was very graciously given me by the Swedish Government during my nine months' stay in that country, when I was permitted to follow the work in four regiments quartered at Stockholm, going to their gymnasia frequently and at all times of the day. I also had the opportunity of studying minutely the training and physique of the large majority of their naval cadets, seamen and stokers.

I have been able to form many valuable practical opinions. The most important of these, perhaps, is that the condition of irregularity of the heart noticed at times in some of our own soldiers is a thing which will probably be far less common in the future. This system of gymnastics has been employed for some years now in nearly every nation in Europe; it forms the basis of the training of the recruits for many armies and navies. The Americans have taken it up keenly, and the interest in it is spreading still further afield, as was evident by the various nations represented at the Central Gymnastic Institute at Stockholm whilst I was there, a Japanese and a Chilian being members of our small squad of foreigners who fell in every morning in the gymnasium.

Here in England, as already mentioned, there has been for some time a strong movement to promote the study and knowledge of physical education on rational lines, and men are devoting their lives to guide the training in our schools on the lines it should be conducted for the benefit of the nation.

Their cause has obtained a sound footing to-day, but is not receiving the attention it so rightly deserves, partly owing, no doubt, to the free dumping-ground our country has offered for numbers of so-called professional experts to practise *their* various methods of physical culture and to advertise these methods as treatment for the cure of all sorts of diseases, so that the mere mention of physical training has come to have an echo of charlatanism attached to it; but chiefly on account of the lack of interest taken in it by the majority of the medical profession.

Surely, gentlemen, a cause with such grand principles as physical education on sound lines offers, has need of the guidance and interest of medical men to keep it on sound lines, and to ward off any taint of quackery. Set aside, for the moment, the great benefits to be derived in the future by endeavouring to build up the physique of the race to-day, and think of the moral effects to be gained on all sides at the present time by instilling a desire for bodily fitness and hygiene amongst the men we are training. A man who keeps himself fit or who is kept fit by regular exercise has an active and *clean* mind; he is temperate in his habits and takes a pride in himself and his surroundings—facts which are undoubtedly worthy of our highest consideration.

For the last two years all naval surgeons on entry come to the Portsmouth School of Physical Training for a short course of instruction, and it has been very gratifying to see the interest taken in the work and the keenness shown to go deeper into the question. It is needless to say how the cause has benefited by their work and by the interchange of scientific opinions bearing on the subject.

I sincerely beg that, as opportunity offers, whether it be at the naval and military training establishments, or at the few civilian schools conducted on proper lines, the senior members of the medical profession will avail themselves of it and study this most important branch of science. Then, and *only then*, shall we be able to keep the work on straight and sound lines, gradually reaching that ideal state when every child in our public and National schools is physically trained daily by the same methods throughout the kingdom, so that the Services may reap the benefit and obtain recruits, who have already reached a certain standard of bodily fitness which will prevent the waste of time and money now of necessity spent in training the raw material we so often receive to-day.

I have already trespassed beyond the time limit allowed to me and yet know that I have not said one-quarter of what I ought to have done on this important subject. It has been impossible to describe any of the details of physical training methods; but if the few disjointed remarks I have just given utterance to have kindled a spark of enthusiasm for the further study of this question in the minds of some of my own profession present here this evening, to whom the question opens up a new line of thought, I shall have accomplished what I had hoped and intended by my paper.

DISCUSSION.

Lieutenant-Colonel M. W. Russell said: I should like first to compliment the writer of the paper on the very lucid exposition he has given us of the Swedish system of physical training, now adopted in our naval and military gymnasia. He urges the medical profession to take a larger share in the science of physical training. With this we are in full sympathy. Military medical officers have for very many years claimed an interest in the physical training of the soldier; but the subject has been looked upon largely as one of drill and the development of muscles, and, as such, not within the immediate province of the medical officer. But of late a material alteration of views has taken place. It has been authoritatively laid down in the official "Manual of Physical Training" that "It is not sufficient to train the muscles alone and to neglect the heart and lungs and other internal organs, for it is on the internal organs that the body depends not only for its health but for its very existence." After this direct acknowledgment that the physical training of the soldier must be based on anatomical and physiological data, the position of the medical officer in relation thereto is made clear, and it is incumbent on him, as the only officer with special training in these subjects, to bring his knowledge to bear, to assist and guide in the carrying out of the training. His co-operation is welcomed. Junior officers of the R.A.M.C. will enter on this branch of their duties specially well equipped, inasmuch as they now themselves undergo the training which they will be called upon later to watch over. Having worn the shoe they will the better know where it pinches. The best criticisms of the system I have heard have come from those who have actually been through the mill. The institution of the present course of gymnastics for junior medical officers is of value not only for the physical benefits each of them derives from it, but especially on account of the insight it gives them into a branch of their duties which will become of increasing importance.

I do not wish to enter into any detailed criticism of the subject; that I wish to hear from others. But there is one little point I should like to touch on. It is perhaps of passing importance, but at the present moment is not, I think, unreal. It has relation to the position of "Attention." The aim of the gymnastic instructor is to produce a position of "Attention" which obviates many of the defects of the time-honoured posture. This must inevitably take time, and is, I cannot help thinking, not accelerated by the different conception of the position on the barrack square. There is at present a certain antagonism—unconscious perhaps, but real—between the position which the gymnasium is trying to inculcate and that adopted in the ranks. The discrepancy may pass away as the relations between the gymnasium and the drill-ground become more intimate, when all responsible for the drill have themselves been through the newer training of the gymnasium. I do not wish to lay too much

stress on this point, but I think it is one which is deserving of some little attention.

Dr. Herringham thought that the question of physical training was of even more importance to a civilian, since the services filtered their supply, but civilians saw at the hospitals men whom the recruiting serjeants had rejected. The English under good conditions were as fine a race as any, but urban life had given the nation a class worse in development and in health than could be found in any other European nation. This was not only a national danger, but a continual monetary loss; and it was from both points of view that the remedy needed serious consideration. It had begun already in the Elementary Schools, where physical training of a simple kind was now obligatory. He hoped that before long Continuation Schools, which were already provided in Scotland, would be given to England too, and would carry on physical training for a few years later than at present. He also looked forward to universal military training at no distant time, believing that it would by its physical training greatly benefit the health, and by its discipline equally benefit the morals, of the whole nation.

Dr. Gilmour said: Physical training, if properly carried out, means mental training. The value of physical training lies not in the mere development of muscle, but in teaching co-ordination of muscular power —that is, in training the whole nervous system. Any good system of physical training should fulfil three of the essentials of sound mental education—namely, to sustain interest, to establish self-control, and to cultivate powers of attention; this last producing alertness and quick response to stimuli. Not only should a proper system of physical training be introduced into schools as an educational measure, but, if possible, the recreation of the young should also be organised. Were good systems introduced and properly carried out, the gain in mental capacity of the nation would be as great as the increase of physical fitness.

Lieutenant-Colonel Melville said he wished to touch on the question of the position of "Attention" which the reader of the paper and Lieutenant-Colonel Russell had alluded to as being a position of strain. He ventured to think that this was a mistake. The position of "Attention" should be one that could be maintained with the absolute minimum of conscious effort, one, therefore, in which immediate attention could be paid to any order that might be received. If the position of "Attention" were one of strain this could not be the case, since not only would the mind be to a certain extent preoccupied so that attention could not be paid to orders received, but before any such orders could be executed a certain amount of muscular relaxation would have to take place, and delay would thus result. He ventured, therefore, to think that the conception of the position of "Attention" as being one of strain was a fundamental and serious error.

Major C. Moore said: Colonel Melville asks me to describe what

advantage is obtained by the position of "Attention." This position as now taught, not only for physical training purposes but throughout the Service, is not one of *strain*, as has been suggested, but one of *readiness*, and every effort is made to avoid all semblance of *strain* and undue effort. The underlying principle that we keep in view is to aim at an erect carriage of the spinal column. If an erect carriage of the spine is attained it follows that the chest will then naturally assume an easy and free position for respiration without any restriction of the mobility of its walls. A great point is made of this and the avoidance of any idea of unnatural *expansion* of the chest. The main idea underlying the position of "Attention" is also looked upon as the fundamental idea underlying the large majority of positions assumed in physical training. It is impossible, however, as has been suggested, to expect that a man should be able to assume this position correctly as soon as the training commences. Previously acquired abnormal curves of the spine and other deformities (*e.g.*, undue dorsal curve acquired by school positions at desks, working at trades, &c.) prevent this, and until these are corrected an ideal position cannot be assumed. One of the objects of our training is to correct or prevent these abnormal conditions, and it is due to the training as a whole that the man is enabled by degrees to assume, or at any rate approximate to, what may be called a normal erect carriage, which is, after all, what is aimed at in the position of "Attention." To guard against any wrong impression as to our aims as regards the physical training of the soldier, it is as well to mention that to teach a man to stand correctly is not the one and only object of the training, but only a small part of it. The greatest attention is paid to the cultivation of freedom of movement, control, and *activity*. Mere muscular strength is not aimed at, but in the process of cultivating activity sufficient strength for all reasonable requirements is acquired, and the man is fitted to undergo his further training as a soldier and for his life as such.

Dr. Pembrey remarked that the medical profession would take more interest in systems of physical training if they were not so contaminated by quackery. It was unwise to consider the Swedish system free from defects. Free and open criticism was needed in the interests of truth and progress. The most marked defect of the system was its gross anatomical bias. Training was not a question of anatomy, but of physiology. Too much stress was laid in the army upon a "smart" military carriage and bearing. The position of attention was one of strain and restraint; it was a conventional position and was no sign of efficiency. The correction of the carriage of recruits could not be altered suddenly, for the body had been growing for seventeen or eighteen years. The attempt at such a correction constantly produced an abnormally marked lumbar curve. Training had limitations; it could not make a cart-horse into a race-horse, but it might make both types efficient for their special uses. A farm-labourer would not be efficient if he walked in the manner of a

soldier on parade. It would be well if more exercises of a natural and useful type could be employed. Digging was hard work and a good exercise, but it had been objected that it made men stoop. Soldiers could be given sound exercise and useful employment at the same time. Some of the Swedish exercises, such as span-bending, disturbed free breathing and were bad. The athletic students of the universities and medical schools would not use such systems of training, and they were right, whether judged by physiological principles or by practical results. The physical degeneration of the race was overstated, and the Swedish system would not save those who were predestined to physical or moral degeneration.

Lieutenant-Colonel H. E. Deane said that the practical interest of the subject of the paper for military surgeons was the effect of exercise on the heart, especially with reference to the "soldier irritable heart." He had thought that pulse-rate after exercise had something to do with the subject, but continued observations were leading him to think that pulse-rate, *per se*, after exercise had nothing to do with it ; and he would have liked to have heard something as to the effect of training on pulse-rate, and commended that point to medical officers for study. He had been making observations on a professional dancer, performing constantly all the year round, whose pulse was 76 before going on the stage and was at the rate of 200 and over immediately on cessation of the dance, though in a quarter of a minute it began to drop rapidly. Regular practice seemed to have no effect in reducing the pulse-rate as a result of the exercise. He again emphasized the point to which he referred in a paper he read before the Society in June, 1908, that Service medical officers had unique opportunities of settling many questions that civil practitioners could not do, because they had not got the material to work on. With reference to Dr. Pembrey's remarks as to the absence of questions on physical training at examinations, the explanation was simple; the physiologists did not know what questions to give; they did not know enough about the subject themselves, and it was not to be wondered at when one considered how practically impossible it was to analyse anatomically even simple gymnastic exercises, to mention only a "slow circle." Quackery was writ large over the whole subject of physical training, and in the Swedish system, though he did not like to apply the word quackery, he might say there was too much stress laid on the necessity of exercises being taken in some particular order, and on certain exercises having such and such physiological effects which had not been and could not be demonstrated. He was glad to hear there was still a discussion as to the position of "Attention," but as no one had given a clear definition of the term, argument simply became conversation. The position, as usually understood, had been considered for many years as one of chest strain.

Lieutenant Coote spoke of the growth of Swedish gymnastics in England as proved by the following facts: There are in England six

training colleges for women, and the students from one of these alone have not only introduced Swedish gymnastics into the Universities of Cardiff, Glasgow and St. Andrews, into Girton and Newnham Colleges, into fifty-two high schools for girls and some hundreds of private girls' schools, but also hold posts under twenty County Councils and School Boards as superintendents of physical training. Although there is no training college for men in England, the half-dozen men who are fully trained, having acquired their knowledge abroad, have nevertheless introduced the system into Eton, Clifton, and Repton Colleges, into some thirty preparatory and other schools, and into the schools under the Glasgow School Board and West Riding County Council. As a gymnastic teacher he pleaded for co-operation on the part of the medical profession, explaining that the development of the work in Sweden was largely in the hands of medical men who gave their whole time to it. He further pointed out that on the part of the medical man there must be, in addition to scientific knowledge, a thorough acquaintance with the practical details, and at least *some* experience of teaching, before his help can be of real value to the gymnastic teacher.

Lieutenant-Colonel A. B. Cottell, after congratulating Surgeon Bell on the many excellent "points" he had made, went on to say that probably the entire condemnation of all the other gymnastic methods, which is the fashion of the day, and pinning our faith absolutely to Swedish exercises, was merely a swing of the pendulum from one excess to another, and the best might still be found in the better parts of each. The old custom was certainly more interesting. One speaker referred to the harm of specialising. Perhaps it often is hurtful, but it is hopeless and useless to contend against it; indeed, it must be recognised that the soldier is after all an excellent example of a highly specialised fighting machine. Another speaker said that we had a worse submerged tenth than any other race. If this be true, which is open to doubt, we must remember that England has been permitted to become the dumping ground of undesirable and quasi-criminal aliens. We had, however, the astonishing spectacle offered us last month of the University boatrace being rowed by two crews whose average height was 6 feet 1 inch. We may take heart of grace that we still are a people possessed of considerable stamina and dogged determination.

Surgeon Bell, in reply, said: I agree with Dr. Pembrey that healthy discussion is the only way to arrive at the basis of any argument, but am not able to understand the implication that a system of physical training is bad because it is a "system."

Naturally, everyone would agree that the ideal state of affairs in this direction would be for each person to train himself physically on his own individual lines. However, this is impossible in the Services to-day. If the men were told to fall out and take physical exercise for half an

hour on the lines which each one felt appealed to him and were left to carry on by themselves, the result would be half an hour's sleep in the majority of cases. Again, it is obviously impossible to have an instructor for each man in order to study the idiosyncrasies of his pupil and train him on his own individual lines, as then 50 per cent. of the ship's company would have to be physical training instructors, and these of a very high standard. Had I myself lived under such ideal circumstances that during childhood a tutor had been engaged for me alone, whose duty it was to study the individual capacity of my brain for acquiring knowledge and then to teach me on those lines—I should no doubt have been a clever person by now. Unfortunately, such was not my luck, so I had to go to a public school, where I was taught on a *system* of mental education in common with some twenty other boys in the form.

I hold that a system of some sort is absolutely necessary for the physical training of numbers of boys and young men, and the whole idea of my paper just read is to solicit opinions and invite study of the question from members of the medical profession, in order that we may be able to guide and control the system adopted.

The exception taken to my remarks on specialising have shown me that my ideas in the way I have expressed them on this point are liable to be misunderstood. I would be the last person to do otherwise than encourage sports as long as there is an element of all-round training embodied in them; but I cannot get away from the fact that we are as a nation carrying competition too far. For example, say for the sake of argument there is a certain regiment which we will call "X" whose bayonet team has won the competition for that event for the last three years at the Naval and Military Tournament, so that they have come to be called "The regiment who are the bayonet champions." Let us look into the state of affairs which is most likely to be happening in that regiment. During all their practice for the regiment's assault at arms each company has gradually realised that it is no use their practising with the bayonet, as A Company has the crack bayonet team which has won the Naval and Military Championship for some years in succession; consequently the bayonet fighting is more and more abandoned by the whole regiment until they are probably the worst regiment all told in this method of attack and defence, and yet have a world-wide reputation for being the crack regiment at the game because eight of their complement have been allowed to specialise at it.

We need some method of general training on rational lines and should not carry our enthusiasm in competition so far as unfortunately seems to be the custom now. We should take steps to ensure that we have some regular training which would have for its object the development of an all-round man.

Clinical and other Notes.

A NOTE ON A DIPHTHEROID BACILLUS ISOLATED FROM WATER.

By Major J. G. McNAUGHT.
Royal Army Medical Corps.

The organism which I am about to describe was isolated from filtered water in a mineral water factory belonging to the South African Garrison Institutes on November 2nd, 1908; a precisely similar organism was isolated from the same water on November 13th, 1908. The water used is an exceptionally pure upland surface water, and the only reason for subjecting it to filtration is to lessen its peaty colour. It is filtered by means of a battery of Pasteur candles, stored in two covered iron tanks, each of 70 gallons capacity, from which it is piped to the soda water machine. The factory is located in an old hut of wood and galvanised iron, it is clean and well managed; the process of filtration, as tested bacteriologically, is frequently found to be defective.

The organism referred to grew in MacConkey's bile salt broth, showing very marked aerobic preferences, the lower part of the broth being quite clear; from the bile salt broth it was isolated on agar and subcultured. Its characters are as follows:—

Morphology and Staining Reactions. (From twenty-fours hours agar culture incubated at 37° C.)

A non-motile bacillus, arranged in Chinese letter fashion. Many individuals are tapered at each end; none show clubbing. They are very distinctly barred. Stained by Loeffler's methylene blue they show chromatin granules very distinctly. They retain the stain by Gram's method. Stained by Neisser's method they show dark blue granules, varying from two to four in each bacillus.

Cultural Reactions.

Gelatin Stab.—Five days at 16° to 20° C. Growth very slight; grey growth all along stab; no liquefaction.

Agar.—Five days at 37° C. Small round grey colonies; dark centres.

Blood Serum.—Twenty-four hours at 37° C. Small round white colonies.

Broth.—Forty-eight hours at 37° C. Profuse growth, pellicle and deposit. Reaction alkaline; 10 cc. of broth took 0·3 cc. $\frac{N}{10}$ K.O.H. to render it alkaline; 10 cc. of a sterile tube of same broth took 0·9 cc. $\frac{N}{10}$ K.O.H. to render it alkaline. Alkalinity due to bacillus is therefore 6 per cent.

Broth.—Five days at 37° C. Very slight indol reaction, only apparent on incubation of tube after addition of potassium nitrate and sulphuric acid.

Neutral Red Broth.—Five days at 37° C. Growth, pellicle, deposit, distinct yellow colour, but no fluorescence.

Litmus Milk.—Five days at 37° C. Growth, no clotting; distinct alkaline reaction.

Glucose Bile Salt Broth.—Forty-eight hours at 37° C. Growth in upper part of broth; no acid, no gas; well-marked pellicle.

I have not had an opportunity of testing the pathogenicity of this organism on laboratory animals. It will be seen that the bacillus resembles *Bacillus diphtheriæ* somewhat closely; it is, however, at once differentiated from it by its forming alkali in broth. I also noticed that while it showed no motility in hanging drop from agar, in broth cultures it was distinctly motile. No bacillus resembling this one was recovered from the unfiltered water, and I think that it probably gained access to the water in the process of filtration, or during storage.

THE ZITTMAN TREATMENT OF SYPHILIS AT NETLEY.

By Major D. LAWSON.
Royal Army Medical Corps.

The Zittman treatment of syphilis was first commenced at Netley in October, 1904, following on the recommendation contained in the first report of the Committee on "The Treatment of Venereal Diseases and Scabies in the Army."

Since then 183 patients have been through the course. Forty-two of these were put through a second course, 10 a third course, 5 a fourth course, 2 a fifth course, and 2 a sixth course, making in all 243 cases.

The following shows the results as reported in each case immediately after the course.

No of cases	Gained weight	Lost weight	Generally improved	Improved	No improvement
243	147	96	132	87	24

The course lasts fifteen days and is as follows:—

On the evening before the treatment begins the patient is given two pills made as follows:—

Hydrarg. subchlor.	grs. ii.
Ext. colocynth. co.	grs. v.
Ext. hyoscyami	grs. ii.

Divide into two pills.

He is ordered a free diet, from which, according to Zittman, sugar and spices should be eliminated, but that is disregarded here. He is kept in bed except for an hour in the evening, and the temperature of the room is maintained at 80° F at least. I generally order the room to be kept at 84° or 85° F.

For the first four days the patient drinks half a pint of the following decoction as hot as possible, at 9, 10, 11 a.m. and 12 noon :—

Decoction No. 1.

Rad. sarsæ contus	℥iv.
Sem. anisi contus	grs. lxxx.
Sem. fœnic contus	grs. lxxx.
Foliæ sennæ	℥i.
Rad. glycyrrh. contus..	℥iv.
Add in a linen bag :—	
Sacch. alb.	grs. lxxx.
Alum sulph.	grs. lxxx.
Hydrarg. subchlor.	grs. lxxx.
Hyd. bisulph. rub.	grs. xx.
Aqua	gals. iii.

Boil to one gallon and strain.

On the same day at 3, 4, 5, and 6 p.m. he drinks half a pint of the following decoction cold :—

Decoction No. 2.

To the dregs of No. 1 Decoction add :—	
Rad. sarsæ contus	℥ii.
Cort. limonis contus	℥i.
Sem. cardam. contus	℥i.
Rad. glycyrrh. contus..	℥i.
Aqua	gals. iii.

Boil to one gallon and strain.

On the fifth day he gets up, and in the evening he has two more pills. The treatment is repeated till the fifteenth day, when it is discontinued and the patient returns to a ward at the usual temperature.

It will be noticed on looking at the prescriptions that the first contains calomel, which is insoluble, and hyd. bisulph. rub., which is almost so, and that the decoction is strained before being administered. The amount of mercury in the decoction is therefore very small, most of it having been removed by straining.

If patients complain of diarrhœa, it has always been found that the straining has been carelessly done and calomel has passed into the decoction. Many patients were put through the course, the mercury, however, being eliminated from the prescription, and it was found that they derived as much benefit as men under the previous treatment.

The essence of the treatment appears to be prolonged diaphoresis and diuresis, brought about by drinking large quantities of highly spiced liquids, and being kept in a room at a high temperature.

Many medical officers who have had charge of this treatment believe

that in the case of men invalided from India who have been a very long time on mercury, and have accumulated a very large quantity in the tissues, the course benefits by assisting them to excrete the drug.

Patients suffering from severe rashes, rupial and other ulcers, bone affections, gummata, destructive lesions of the nose and syphilitic rheumatic pains in the limbs and joints appear to benefit much by this treatment, but affections of the mucous membranes do not appear to yield to this treatment. In many cases the patients lose weight during the course, and gain considerably during the six weeks following.

The course is, in spite of the great discomforts attending it, very popular amongst the men, who have the greatest belief in it and frequently ask to be put down for a second course within a few weeks of concluding the first.

The difficulty up to the present has been to maintain a ward at the high temperature and ventilate it sufficiently, but this will shortly be overcome by the installation of a special hot air apparatus and boiler.

COMPRESSION OF THE BRACHIAL PLEXUS DUE TO MAL-UNITED FRACTURE OF THE CLAVICLE.

By Captain G. J. STONEY-ARCHER.
Royal Army Medical Corps.

Private J., 2nd Royal Sussex Regiment, aged 20, service one year, was admitted to the Military Hospital, Belfast, last September, complaining of great weakness in the left arm and severe pain in the left clavicular region, in consequence of which he was unable to carry his rifle in his left hand, or even to bear the weight of his suspender over the left clavicle.

The history of the case was as follows: Last April when stationed in England he fractured his left clavicle playing football. It was put up by Sayer's method and was evidently uniting satisfactorily, when just a month from the date of the first accident he got drunk and fractured it again in the same place. It was again put up by Sayer's method, but from this time on up to the date of admission here he stated that he had suffered from pain in and around the seat of the fracture, and also from shooting pains and tingling sensations in the left arm.

On examination, sensation to pin prick and to heat and cold was found to be lost over the anterior, outer and posterior three-fourths of the arm, from the top of the shoulder to the tips of the fingers. Sensation was present over an ill-defined area running down the inner side of the arm and also over the little finger, half the ring finger, the inner side of the thumb and the outer side of the first finger, that is, the area supplied by the inner cord of the brachial plexus, the intercosto-humeral and a small portion of the median. He could only give a very feeble hand grasp and

all the muscles of the left arm and forearm were wasted, flabby and weak, and movement of the arm was limited in an upward direction on account of pain. The reaction of degeneration was not present, but the muscles only reacted sluggishly to the interrupted current.

On examining the seat of the fracture the inner extremity of the outer fragment was found to be lying very deeply, behind and below the outer extremity of the inner fragment, which latter could be felt ending abruptly about $2\frac{1}{2}$ inches from the sternum. It seemed probable, therefore, that the symptoms were due to pressure of the inner end of the outer fragment on the posterior and outer cords of the brachial plexus above the level where the circumflex nerve comes off the posterior cord.

As palliative treatment proved quite useless, on October 23rd, 1908, I exposed the clavicle by a curved incision passing an inch below the level of the bone, and then dissecting up a flap of skin and fasciæ. The inner portion of the outer fragment which was lying behind and below the inner fragment was removed with chisel and bone forceps, and the cut

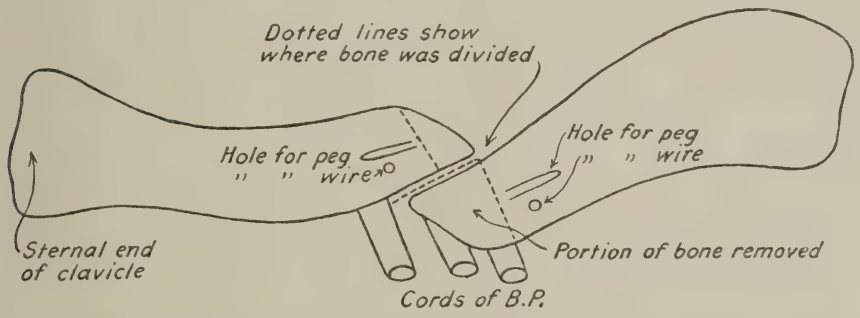


Diagram showing Relation of Broken Ends to Cords of Brachial Plexus.

end of the former bone being drawn forwards and upwards to the level of the outer free end of the inner fragment, this latter having been freshened with the saw, the two portions of bone were approximated with a strong loop of silver wire. An ivory peg about 2 inches long was inserted longitudinally through the centre of the divided ends with the object of preventing the outer one from again falling backwards and downwards. The periosteum was then drawn together with chromicised catgut, and the wound closed without drainage.

Two days after the operation he told me with evident satisfaction that the skin on the back of his hand was itchy, and that he could feel himself scratching it; on the third day he could feel pin pricks all over the back of his hand, and he said that tingling sensations were running up and down the outer part of his arm and forearm; on the fourth day he could feel pin pricks as high as 2 inches above the wrist and said that his hand felt "as light as a feather," before the operation he had often complained

that his hand felt as heavy as lead; on the fifth day he could feel all over the arm to the top of the shoulder, in fact, everywhere where previously insensibility was lost; on this date it was also noticed that his hand was damp with perspiration, instead of as formerly, dry and the skin inclined to be red and shiny. From this time on his recovery was uneventful and in every way perfectly satisfactory, sensation was completely restored, the muscles of the arm and forearm regained their tone and strength, and movement at the shoulder-joint became perfectly free in every direction. The only post-operative treatment was carefully graduated massage and passive and active movements. He was discharged hospital to furlough on December 18th, 1908. The radiograph shows the bone united in perfect position, and the rough sketch shows diagrammatically the position of the fragments to one another and their supposed relation to the cords of the brachial plexus before the operation.

The case is of interest, I think, chiefly for two reasons; first, because it is extremely rare to find injury to the brachial plexus associated with fractures of the clavicle; and secondly, because it bears out the latest teaching, that where mixed nerves are injured the sensory affection is more marked than the motor lesion, whereas till very recently it was thought that the motor fibres were more affected than the sensory.

I have to thank Captain E. P. Sewell who ably assisted me at the operation, and Lieutenant Phillips, R.A.M.C., who gave the anæsthetic.

A CASE OF ALBUMINURIA IN PREGNANCY WITH PRE-ECLAMPTIC SYMPTOMS.

By Captain TOBIN.
Royal Army Medical Corps.

Drs. Tweedy and Wrench speaking of the significance of warning signs and symptoms say: If a patient complains to you in the later months of pregnancy of symptoms of toxæmia such as headache, vertigo, functional disturbances of vision, insomnia, drowsiness, puffiness under the eyes, &c., make an examination of her urine for albumin, and if it is found treat her for albuminuria. You may thus ward off eclampsia, a disease that has a mortality of between 20 and 30 per cent. The significance of warning signs and symptoms and the importance of their early recognition could scarcely be greater. Albuminuria and eclampsia must be considered together, because although eclampsia may very exceptionally occur without albuminuria they are almost invariably associated. This association is indeed so marked that the conclusion cannot be avoided that they are due to one and the same cause, viz., a form of toxæmia. Well-marked albuminuria in pregnancy is fairly uncommon as the rate of its frequency does not exceed 3 per cent. in pregnant

women, and from this we must deduct cases of pre-existing renal disease and cases of transient functional albuminuria.

Clinical Notes of the Case. — Mrs. S., wife of Serjeant S., South Staffords, aged 22, was sent to hospital said to be suffering from fits. On admission she complained of weakness, persistent frontal headache, giddiness, vomiting, and suffered occasionally from stupor and despondency. There was puffiness under the eyes, and œdema of the feet and ankles. Before admission she appeared to have had several attacks of "petit mal." On examining a specimen of her urine withdrawn by a catheter a large amount of albumin and hyaline and granular tube casts were found. She was a primipara and pregnant about eight months.

Treatment.—The patient was put on milk diet with two pints of lemonade daily, one ounce of Henry's solution was given each morning, also a diaphoretic mixture and a daily hot bath were taken; the patient was made to sleep between blankets. This line of treatment was strictly adhered to and continued during the puerperium. Daily examination of the urine showed a decrease in the output of albumin, but it did not completely disappear from the urine. On January 11th, 1909, labour pains set in, and after about seven hours, when the pains were severe, the patient became exhausted, and showed signs of instability of the nervous system with twitchings of the facial muscles. Vaginal examination showed dilatation of the os but not sufficient to apply forceps. Following the Rotunda method of treatment, the patient had an injection of one grain of morphia, and soon after went sound asleep and slept for six hours. Arrangements were made for saline infusion, &c., &c., in case an eclamptic seizure set in, but when she awoke the exhaustion had passed off and labour went on to a favourable termination. After the child was born half a grain of morphia was administered as the instability of the nervous system appeared again. During labour a specimen of the urine withdrawn by catheter showed complete absence of albumin, but it appeared again on the first day of the puerperium. This is a point of clinical importance, as the patient might be considered as a case in which there was threatened eclampsia with absence of albumin in the urine during labour, and so come under the heading eclampsia without albuminuria. Whereas there was well-marked albuminuria during pregnancy and in the puerperium. During the third stage it was noticed that the blood was very fluid and showed no tendency to clot, the uterus did not contract and it was only after massage and suprapubic pressure followed by a large dose of ergot that contraction set in and hæmorrhage ceased.

In conclusion, the best etiological theory of eclampsia at the present time, although it may not be correct in all details, is that eclampsia is due to toxæmia. Taking this for granted, then the prophylactic treatment of eclampsia is far more important than the curative, since it is usually possible to prevent the attack.

ANEURYSM OF THE ABDOMINAL AORTA.

By Lieutenant-Colonel C. T. W. TATHAM.
Retired pay, late Royal Army Medical Corps.

The following notes may be of interest, owing to the difficulties in diagnosing the case.

Private W. J., 2nd Border Regiment, was admitted to hospital at Sheffield, on October 5th, 1908, complaining of general weakness, inability to eat solid food, and shooting pains all over the trunk, specially severe at night, but not worse after food. His medical history sheet showed an entry for syphilis some years previously, and he was in hospital at York for thirty-four days during June and July, 1908, when the diagnosis of inflammation of stomach was made. He stated he had suffered from dyspepsia on and off for several years in South Africa, and also when he returned with his regiment; a year ago he had a severe and prolonged attack whilst on furlough. His relatives informed me that he had always been a great "sprint" runner, that he won the regimental "sprint" race at Strensall in 1908 but that directly afterwards he was laid up with the illness for which he was admitted into the Military Hospital, York. His own view was that he had never been really well since.

On admission his temperature was normal, the only symptoms were anorexia with occasional attacks of nausea and retching, obstinate constipation, relieved by calomel and attacks of lancinating pains in chest, shoulders, arms, and back. His case was diagnosed as "indigestion," he was placed on milk diet and treated with stomachic sedatives, and also with mercury and iodide of potash. By November 10th he had much improved, the pains were gone, he was able to eat chicken diet, and had gained 10 lb. in weight.

He was transferred for change of air to Scarborough on November 20th. On arrival he was most anxious to be allowed to "attend" and not remain in hospital, as he said he felt quite well. He was thin and pale, and looked anæmic; but possibly I might have granted his request only I found he had come without a greatcoat, and I told him he had better wait till this arrived. There were no objective symptoms. He had a good appetite—smoked a great deal—and said he had no pain. On November 23rd he walked (with others) to church, more than a mile away, and enjoyed the walk. He continued quite well until the morning of November 26th, when he had an attack of nausea and retching with a return of the pains in the chest. He said it was similar to previous attacks and he attributed it to constipation. This was relieved with calomel and he was placed on milk diet. On November 28th and 29th he was up most of the day, sitting before the fire. He was better than he had been, but his appetite was poor and he still complained of pains in the chest—particularly under the right breast and between the shoulders. Temperature was normal; pulse regular, 72. Between 3 and 4 a.m.

on November 30th, the night-orderly who was with him heard him move and groan or cough in his sleep; he did not speak, but drew up his legs, and passed into a condition of syncope from which he never rallied.

A *post-mortem* examination was made thirty-two hours after death. The heart and lungs were healthy, but absolutely drained of blood and considerably below the normal weights. The thoracic aorta presented several patches of atheroma about the arch, but there was no dilatation and no aneurysm. The œsophagus was carefully examined for stricture or obstruction, but none existed.

The abdomen was full of blood, the flanks, hypogastric regions and pelvis contained immense blood-clots, the source of which was not at first apparent. The stomach was seen to be in a condition of hour-glass contraction, and both the anterior and posterior walls, especially along the middle of the greater curvature, were greatly thickened and indurated. There was no ulceration of the mucous membrane and no constriction of either the cœliac or pyloric orifices. The intestines were healthy and were removed *en masse*, together with the pancreas. Above and behind the pancreas, and firmly adherent to it by a large amount of adventitious tissue in the region of the cœliac axis there was an aortic aneurysm, the size of an egg, which was slightly torn in removing the pancreas. A catheter passed into the upper end of the thoracic aorta came out in the aneurysm. It had grown forwards and to the left, pressing on the pancreas, and possibly the thickening of the walls of the stomach was due to its pulsation. The splenic artery could not be found and appeared to have been obliterated: the spleen was the smallest I have ever seen, weighing only $2\frac{1}{4}$ ounces against the normal weight of 6 to 7 ounces. There was practically no erosion of the vertebræ. The aneurysm had ruptured into the peritoneal cavity, which contained all the blood of the body. Except for small patches of atheroma the rest of the aorta was healthy.

Abdominal aneurysm was not diagnosed during life. The question of aneurysm was considered, but it was with reference to thoracic aneurysm, and of this there were no definite symptoms. The patient localised the pain of which he complained almost entirely to the thoracic region, and though at the time of his attack of vomiting the epigastrium had been carefully examined, while he was lying on his back, there was no tenderness and no pulsation was apparent. It is possible that the thickening of the stomach walls and flatus in the intestines might tend to obscure pulsation, but in some recorded cases none has been present, either because the sac was hard and thickened, or because the aorta had been compressed on the proximal side by the growth of the aneurysm itself. As to whether the aneurysm had been leaking for some days, or ruptured suddenly—and if so, what was the exciting cause—I am uncertain. Possibly the former was the case, the leakage being started by the retching and the final rupture by a fit of coughing or some respiratory spasm, but there was no clinical evidence of this.

Capt A. E. Weld

MIDWIFERY WORK AT THE CURRAGH CAMP.

By Major S. F. St. D. Green.
Royal Army Medical Corps.

The following notes on the midwifery work at the Military Families Hospital, Curragh Camp, during the period of December 1st, 1905, to November 30th, 1908, may be of interest.

1906	.. ..	70 cases
1907	.. ..	92 ,,
1908	.. ..	120 ,,
		282 ,,

PRESENTATIONS.

VERTEX L.O.A.—149..
- One case was a twin.
- Retained placenta or membranes—3 cases.
- Rigid os requiring dilatation—2 cases.
- Forceps—9 cases:
  - Eclampsia—3.
  - Severe albuminuria and dropsy—2.
  - Primary uterine inertia—4.
- "Fits"—2 cases.
- Eclampsia—4 cases.
- Accidental hæmorrhage—1 case.
- Rupture of umbilical vein of cord during labour—1 case.

VERTEX R.O.A.—85 ..
- Hydramnios—3 cases.
- Forceps—2:
  - Pelvic contraction slight—1.
  - Primary uterine inertia—1.

VERTEX R.O.P.—9 ..
- Frontocotyloid becoming face to pubis—2.
- Forceps—3 (1 for inertia).

VERTEX L.O.P.—5 ..
- Twin—1.
- Forceps—1 (primary uterine inertia).

BROW—1 .. ..
- Accidental hæmorrhage at 5½ months.

BREECH R.S.A.—1 ..
- Accidental hæmorrhage 5th month; labour induced.

,, R.S.P.—1 ..
- Unavoidable hæmorrhage; placenta marginata. Patient had antepartum hæmorrhage for a week previous to admission. Temperature 101° on admission. Recovery uneventful. Fœtus dead.

TRANSVERSE—2 ..
- 1 accidental hæmorrhage at 5½ months. Fœtus delivered by mechanism of spontaneous evolution.
- 1 full time, converted into L.O.A. by ext. cephalic version.

Abortions (under 4 months)—24 cases.

Ectopic gestation—1 case.

Eclampsia—4 cases (all L.O.A.); one patient died.

Forceps used 15 times
- Eclampsia, 3; contraction, 1; occipito-posterior, 2; primary uterine inertia, 7; albuminuria, 2.

Labour induced 8 times
- Eclampsia, 2; antepartum hæmorrhage, 4; severe and increasing albuminuria, 2.

The only cases of interest were the ectopic gestation (already reported in the Journal, dated March, 1908), and the six cases of "fits," four of which were undoubtedly puerperal eclampsia, and the others probably so. I give short notes.

Case 1.—On admission was in the second stage of labour; she had very slight dropsy of legs; urine contained half albumen; labour was apparently normal. Immediately on birth of the placenta the patient had four eclamptic fits at intervals of twenty minutes; she was given morphia

½ grain hypodermically, and chloroform inhalations. After treatment: hot packs, cathartics, plain milk diet, &c.; twenty days after labour urine had slight traces of albumen, and the patient was allowed up for one hour in a chair. During the night she complained of intense headache, and became suddenly collapsed, and on the morning of the twenty-first day was comatose (could be roused with great difficulty), the pulse full, strong, very slow, 40 to minute, respirations 28, rectal temperature did not rise above 96° F., limbs were apparently paralysed, knee-jerks present not exaggerated, passed her evacuations under her. Treatment: calomel, ice to head, rectal feeding, rectal salines, and later iodide of potash (this did not suit her and was soon stopped). She remained in this condition about four days, when it passed off and consciousness returned; this was followed by slight slurring of speech, deafness, squint, facial paralysis, slight incoordination of movements of arms (grip was apparently normal), hyperæsthesia of back of head and neck (sensation otherwise unaffected), and when she first got up she dragged her right leg a little.

Gradually the whole of her symptoms passed off. She eventually left hospital after a stay of two months apparently quite well. I have seen her since (eighteen months after), and she reported that she had been quite well all the time.

Case 2.—Was discovered in her quarters in an eclamptic fit, during which she bit her tongue badly. She was seven months pregnant. In fourteen hours she had eighteen very severe fits, and was under chloroform continuously for seven hours, and had morphia ½ grain hypodermically. Labour was induced under chloroform by dilating the os with Hegar's dilators, and de Ribes' bag and delivery aided by forceps. Urine had three-quarters albumen, after treatment same as case 1. The puerperium was uneventful, and on leaving hospital the urine was free from albumen.

Cases 3 *and* 4.—Both these patients had one single fit immediately on the termination of labour; they were given chloroform and the fit was not repeated. Both had dropsy of face and legs, had complained of headaches and had urine loaded with albumin. In both the puerperium was normal, and on their discharge the urine was free from albumin. In neither case was there a history of epilepsy.

Case 5.—Was admitted from Newbridge, having been found in a fit, urine three-quarters albumen; had twenty-two fits in all; labour induced; fœtus was dead; phlebotomy was done and 8 ounces of blood withdrawn, the remainder of treatment same as previous cases. Patient made an uneventful recovery.

Case 6.—Was under a civil practitioner originally, and on admission had been having fits every ten minutes for five hours. On examination there was suppression of urine, the os fully dilated. The child was delivered by forceps, and born dead. The fits continued. Treatment the same as above. The mother died eight hours after admission.

THE AUSTRALIAN ARMY MEDICAL CORPS.

By Major S. F. CLARK.
Royal Army Medical Corps.

It is a calamity for us that Australia is no longer a Colonial station. The great majority of Britishers have no conception of the vastness of it —of its wealth, resources, climate, and general desirability. It ought to have a great future, and one hopeful sign is that its people are recognising their defenceless condition, and the Government has brought in a scheme of compulsory military training for all youths. For proper security Australia requires population, and its far-seeing men are doing their best to encourage immigration to its shores.

During a recent visit to Sydney, I was hospitably received at the barracks, and was shown everything by the Australian Army Medical Corps. The barracks and hospital had a familiar look about them; they were built in 1842, and were occupied by British troops till 1870. They are walled round in the old style, on ground that is very valuable, but at one time the officers' gardens extended to what is now the racecourse (or rather, one of many) and Sydney cricket ground.

The Commonwealth troops have decided to adopt our sanitary organisation, and I accepted an invitation from the Council of the United Service Institution of New South Wales to deliver a lecture on our latest methods of sanitation. The Corps Journal reaches Sydney, and is thought well of.

In Australia all troops are now under the Commonwealth Government, and are no longer managed by the different States. As the information contained in this article is published openly in Australia, no secrets are being divulged to foreign nations! The troops are divided into:—

(1) *A permanent cadre force*, consisting of the Staff, the Royal Australian Artillery Regiment (garrison gunners), and small detachments of auxiliary corps, such as engineers, Army Service Corps, Medical Corps, &c. These are the regular troops, and they exist mainly for manning fortifications, for the maintenance of stores, and for instructional duties. This force also supplies the chief Commanders and the Staff in war.

(2) *A field force* of militia, furnished by the six States on a population basis. These men pursue their ordinary employment, but are paid so much for each parade they attend.

(3) *A garrison force*—mainly unpaid volunteers.

There are also Reserve Forces, consisting of members of rifle clubs and persons who have served.

The backbone of this army is the militia force: it not only is the strongest numerically, but it consists of all arms; while the volunteers provide infantry only, with (in New South Wales) twenty-four chaplains and twenty-six ladies of the nursing reserve. The numbers of fighting men are so small that they will not be mentioned in view of the proposed universal training.

In the Australian Army Medical Corps of New South Wales, which may be taken as an example of the organisation for all Australia, the permanent force consists of 10 of all ranks, the militia 240, and the volunteers 26 (nursing reserve). The volunteers, however, have a certain regimental medical organisation in addition.

The whole medical arrangements are under the Director-General (a surgeon-general), whose headquarters are at Melbourne. He, and a quartermaster for each State, are the only "whole time" medical officers, as all other officers of the Australian Army Medical Corps must hold a militia commission. One of these militia officers is in charge of the military hospital at Sydney, and does all medical work needed by the permanent troops. He has no disciplinary power over his hospital staff, however (the ten regulars), who are commanded by the A.A.G.

The uniform of the Australian Army Medical Corps is based on ours, but now practically only khaki serge is issued. It is of the universal Commonwealth pattern, but all ranks wear a chocolate-coloured tab as a Corps mark, while each man has a leather pouch in which dressings are carried. The motto of the Corps is "Paulatim" (little by little), and the badge is a Geneva cross with a spray of laurel on each side, the whole enclosed in a six-pointed star, with a crown on top and the motto below. Orderlies are not divided into sections. Owing to the small numbers of sick, nursing sisters are not employed in peace time, but the ladies of the reserve undergo a week's training in the military hospital every year. Cases of venereal disease lose all pay while they are in hospital.

The King's Regulations do not run in Australia, where they have their own rules. The medical regulations are based on ours, and the equipment is after the British pattern, but tortoise tents and Norton stretchers are used freely. Our field ambulance organisation is about to be adopted.

The Australian Army Medical Corps differs from us in one important point, in that it has its own transport. At the hospital I was shown endless ambulance wagons, general service carts, and Maltese carts, with all the necessary harness and saddles. The drivers are all Australian Army Medical Corps men. During peace time horses are not kept, but once they are provided, on mobilisation, no other corps has any say in regard to them.

Each State has a Principal Medical Officer (militia), who may be of any rank, combatant titles being used all through the corps.

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EXAMINATION OF ELEMENTARY SCHOOL CHILDREN.

By Lieutenant-Colonel B. LANGLEY MILLS.
Royal Army Medical Corps (R.).

The following averages and percentages compiled from four months' systematic examination of elementary school children at Sheffield may be of interest.

The Board of Education have directed that all fresh admissions (infants) and all children leaving school on or before the end of July, 1909, are to be examined, and the results recorded. The total number of these two classes is estimated here at about 17,000, and one Medical Inspector working full time can inspect about 200 in a week of five school days.

The total number inspected in the four months amounts to 2,319.

Group I. Boys of 12—550. Weight 32·16 kilos. Height 134·48 cm.
Boys of 13—176. ,, 33·87 ,, ,, 140·25 ,,

Of these 726 boys 12 per cent. had perfect teeth. The examination of the teeth was by rapid inspection only, without a dental mirror, so that it is probable that about 5 per cent. had really perfect teeth to begin their after school life with, and some 40 per cent. had six or more decayed teeth.

No less than 67 per cent. had enlarged cervical glands, and 39 per cent. had enlarged tonsils, 25 per cent. had various defects of vision, 12 per cent. suffered from "dots" on the skin, due to the irritation of pediculi and fleas, and 6 per cent. had nits in their hair.

The lowest averages in weight and height were found in three schools where the buildings are old and in very crowded localities, with poor air space and practically no playgrounds:—

Group II. Girls of 13—168. Weight 33·16 kilos. Height 135·08 cm.
Girls of 12—610. ,, 32·70 ,, ,, 132·05 ,,

Of these 778 girls 9 per cent. had perfect teeth, 74 per cent. enlarged cervical glands, 51 per cent. enlarged tonsils, 29 per cent. defects of vision, 14 per cent. "dots," and no less than 76 per cent. had nits.

The lowest averages in weight and height are again found in the same three schools:—

Group III. (*a*). Infants—Boys.
Boys of 3—36. Weight 14·75 kilos. Height 90·74 cm.
Boys of 4—144. ,, 15·92 ,, ,, 94·91 ,,
Boys of 5—225. ,, 17·17 ,, ,, 102·22 ,,

Of these 405 infants only 28 per cent. begin their school life with perfect teeth, 49 per cent. had enlarged cervical glands, 25 per cent. had enlarged tonsils. This percentage, owing to the difficulties of examination, is probably far too low; 4 per cent. had defects of vision caused by squint, 7 per cent. had "dots," and 3 per cent. nits.

GROUP III. (*b*). Infants—Girls.

Girls of 3—38.	Weight 14·03 kilos.	Height 95·41 cm.
Girls of 4—122.	,, 15·30 ,,	,, 97·33 ,,
Girls of 5—250.	,, 16·48 ,,	,, 100·97 ,,

Of these 410 girls 30 per cent. had perfect teeth, 59 per cent. had enlarged cervical glands, 22 per cent. enlarged tonsils, 2 per cent. squint, 9 per cent. "dots," and 59 per cent. had nits.

All these children were examined after their parents had received some days' notice. In one of the worst schools I examined 181 girls without notice. Four girls had clean heads, 177 had nits, 33 had head-lice, and 55 had body-lice.

I hope in a future paper (with larger numbers) to deal fully with the various diseases discovered: 1·5 per cent. of all children had marked rickets, 4 per cent. adenoids, 4 per cent. high palates, while among the curiosities were two girls with bicoloured eyes (one blue, one brown), two cases of Friedreich's disease, one dextro-cardia, and three cases of intra-uterine amputation of the upper extremity.

Report.

THIRD REPORT OF THE COMMITTEE ON PHYSIOLOGICAL EFFECTS OF FOOD, TRAINING, AND CLOTHING ON THE SOLDIER.

REPORT UPON FOOD.

A PROPER supply of food is absolutely necessary for the maintenance of health and vigour, and for the supply of energy during the performance of muscular work. This truth is generally recognised, but there has been some difference of opinion as to the nature and amount of food required by men under different conditions. Instinct and the customs embodying the results of past experience will usually afford safe enough guidance, but in many cases, such as the Army, Navy, schools and institutions maintained by the State, a dietary must be arranged, and there are on record numerous instances of the bad effects of an insufficient diet, or a too rigid one, which does not provide for the individual variations in the needs of different men. All modern scientific work shows that the question of food is a most complex one; it is not sufficient to calculate only the energy which will be yielded by the food consumed, but it is also necessary to take into account the chemical structure of the food substances and the personal variations, the needs, and even the likes and dislikes of different men. Food which is not consumed with relish does not produce the beneficial effect which can be obtained from food which

is enjoyed; the likes and dislikes of a healthy man are the expression of physiological needs.

It appears desirable that this introduction should contain a short account of the various uses of the chief food substances, and some reference to keenly debated questions in dietetics. There are three classes of food substances—proteins, fats, and carbohydrates. Meat is a typical protein; fats are well-known articles of animal or vegetable origin; and carbohydrates are represented by the starch and sugar which abound in most vegetable foods. Proteins are nitrogenous substances produced by vegetable or animal organisms; fats and carbohydrates contain no nitrogen. These food substances play different parts in the nutrition of man. A certain amount of protein is absolutely necessary for the support of life, and for the growth and repair of the tissues. There is always a loss of nitrogen in the excretions from the kidneys and bowels, and this can only be replaced by protein material in the food consumed. In addition to this nitrogenous waste, there is a far greater using up of food material in supplying the body with heat and other forms of energy, including the energy expended in muscular work. For the supply of this energy either protein, carbohydrate, or fat may be used up, according as one or the other is most abundantly supplied, and the body substitutes one of these substances for another in proportions which coincide exactly with the amount of energy which they are capable of liberating. This energy value is most conveniently expressed in calories, a calorie being the energy, in the form of heat, required to raise the temperature of 1 kilogramme (2·2 lb.) of water by 1° C. (1·8° F.). Roughly speaking, 1 gramme of protein or carbohydrate is capable of yielding by its decomposition in the body 4·1 calories, and 1 gramme of fat yields 9·3 calories.

The body normally contains a large reserve of energy-forming material —sufficient to last for several weeks during rest—in the form of fat. Only a small amount of surplus carbohydrate or protein is stored up, so that during starvation the reserve of fat supplies nearly all the energy, and the waste of protein, which is reduced to a minimum, is at the expense of the muscles and other living tissues. When, on the other hand, a superabundance of food is taken, the protein is used up most readily. Further energy requirements are supplied preferably at the expense of carbohydrates, any excess of carbohydrates being converted mainly into fat and stored in this form; while fat itself is simply stored up if not required for energy production. A continued excess of carbohydrate or fat may thus lead to the body being burdened with fat, but this, practically speaking, never occurs in the case of healthy men doing a natural amount of muscular work, as there is a normal balance between appetite for food and the physiological need of it. With insufficient muscular work this balance may be disturbed, as is often seen under the

artificial conditions imposed by civilisation, or by want of healthy employment, arising from whatever causes.

The extended observations, made on men of varying social positions and races during the last few years by Atwater and others, show that men doing a moderate amount of muscular work liberate daily in their bodies an amount of energy equivalent on an average to about 3,500 calories. Hence the food supply requires to be capable of supplying this amount of energy; and if its composition and amount are known we can roughly judge of its average sufficiency in respect of energy value. During hard muscular work, however, the energy waste may be considerably greater, so that a corresponding increase in food supply is needed to prevent waste of the tissues. On the other hand, if the employment is sedentary, as in the case of many professional men, the energy requirements do not need 3,000 calories, and any further supply may lead to excessive deposition of fat or other disturbances.

Although 3,500 calories may be taken as a fair average for the requirements of a man doing a moderate amount of muscular work, yet there is every reason to believe that considerable individual differences exist. The bodies of some men seem to be less economical of food-material than those of others; besides which there are differences in size, age, activity, &c., which must be allowed for. Appetite for food may also vary from day to day. Hence, when each man is placed on a diet rigidly fixed as regards its energy-value there is inevitable waste of food, side by side with which there may be insufficiency for many of the men.

It must therefore be clearly borne in mind that any standard energy-value which may be fixed on in calculating a dietary is only an average value, and that a considerable margin must be left for each individual, so that both waste and insufficiency may be avoided as far as possible.

It it also essential that a dietary should be as varied as possible. Experience shows that an unvaried diet may be not only extremely distasteful, but may have serious consequences as regards general health and liability to disease. The causes of this are not yet quite clear, but there is no reason to doubt that the varying appetite for different kinds of food is an expression of physiological needs of which we cannot as yet give a strict scientific account. We do not know the exact conditions which, in extreme cases, render bodies of men liable to such diseases as scurvy or beri-beri, but these conditions are certainly dependent on monotonous diet in some form.

If the diet is insufficient in energy-value, the inevitable consequence is either that the body wastes and becomes liable to the infective and other diseases which are so characteristic of famines, sieges, &c., or that the amount of work falls to a minimum, with marked inefficiency in the performance of all duties. A considerable amount of food (about 2,500 calories in energy-value) is required for simply maintaining the body at normal temperature in a state of rest. It is only the excess beyond this

that is in the long run available for muscular work. The starving body reduces waste by reducing muscular work to a minimum, and a starving man is consequently incapable of any hard muscular work, even though his body still retains a considerable reserve of energy-producing material in the form of fat. To cut down the food supply of an army is thus a fatal form of economy. It renders an army wholly inefficient as a fighting machine besides hampering it by excessive losses by disease, and the necessity of providing for enormous numbers of sick men.

In recent times there has been considerable discussion as to the minimum protein requirements of a healthy man. It has been experimentally shown that men can lead a healthy existence on much less protein than is ordinarily consumed, and it has even been maintained that the amount of protein usually consumed is harmful as throwing excessive work on the kidneys, &c., in the elimination of the waste products of protein decomposition. For the latter contention there is certainly no basis on known facts, and it would be just as reasonable to argue that a reduction of the supply of protein would lead to atrophy of the kidneys for want of work. On the well-known "Banting" system of diet, so often used with the best effects in the treatment of obesity, the consumption of protein is greatly increased, with no indications of resulting harm. The question whether protein consumption could be largely reduced without harm is a more difficult one, and from the physiological side there seems to be no very definite reason for doubting that, provided sufficient protein is taken to permanently compensate for the waste of nitrogenous material, a large proportion of the protein ordinarily present in our diet may be replaced by carbohydrate or fat. On the other hand there stands the fact that as a general rule the most vigorous races and the strongest and most healthy individuals undoubtedly consume the greatest amounts of protein. This may, of course, be a mere coincidence, but at present the balance of opinion amongst physiologists is against cutting down the allowance of protein to much below the average among healthy and vigorous men of about 125 grammes daily. The question, it may be added, is to a large extent an academic one, as most ordinary food materials afford a pretty abundant supply of protein when taken in the proportions necessary to afford also the energy-value, and to be eaten with relish.

So far as is known, carbohydrates and fats are interchangeable with one another as foods in terms of their energy values. Fat in moderate amount is, however, very easily digested and absorbed. It is also an extremely concentrated form of food, since its energy value is very high, so that it is a very valuable nutrient substance, and should, if possible, be liberally represented in a dietary.

The experiments and observations of the Committee may be arranged under the following headings :—

(I.) The quantity, nature, and variety of the food required by the soldier during peace. Peace ration.

(II.) The quantity, nature, and variety of the food required by the soldier during war. War ration.

(III.) The composition of tinned meats and the influence of preservatives.

(IV.) Messing arrangements.

(V.) Conclusions.

(VI.) Appendices.

(I.) *The Quantity, Nature, and Variety of the Food required by the Soldier during Peace. Peace Dietary.*

A considerable number of data exist to show the amount and nature of the food consumed by civilians under different conditions, and from these Atwater has constructed his well-known standards of diet. In order to compare with these standards and with the peace rations of foreign armies the value of the food supplied to the soldier during peace, a calculation has been made of the general composition and energy value of the messing and rations of companies of four British regiments. The quantities of food represent the minimum diet as given by the messing accounts and the ordinary Government ration; no allowance has been made for the food bought at the coffee shop or elsewhere. Waste, on the other hand, has not been taken into account. The values of the different articles of food have been calculated in terms of protein,[1] fat, carbohydrate,[2] and calories,[3] and for this purpose the tables of Atwater and Bryant have been used. The ration of $\frac{3}{4}$ lb. of meat has been calculated from the value of a side of beef as purchased in order that some allowance may be made for bone. The composition of the food for each day during a month has been calculated, and from the data so obtained the average, maximum, and minimum have been taken.

Date, 1907..		June	April	May	May
——		Cavalry	Infantry depôt	Infantry, English	Infantry, Scotch
Average number of men		143	79	103	48
Protein in grammes per diem per man	Maximum..	164	160	170	138
	Average ..	137	131	142	123
	Minimum..	111	116	117	111
Fat in grammes per diem per man	Maximum..	170	138	169	142
	Average ..	131	105	113	112
	Minimum..	93	90	74	102
Carbohydrate in grammes per diem per man	Maximum..	513	537	493	458
	Average ..	421	461	414	412
	Minimum..	357	385	333	383
Calories per diem per man ..	Maximum..	4,224	3,854	4,194	3,612
	Average ..	3,478	3,409	3,340	3,248
	Minimum ..	3,068	3,024	2,779	3,032

[1] Protein—nitrogenous substances similar to white of egg or meat absolutely necessary for life.

[2] Carbohydrate—starches and sugar.

[3] Calorie—heat required to raise 1 kilogramme of water (2·2 lb.) through 1° C. or through 1·8° F.

It is to be noted that in addition to the above diet the soldier constantly obtains, at his own expense, a supper which generally contains meat, but there are no data from which the value of this meal can be calculated. The following articles of diet were included in the monthly returns :—

Beef, liver, bacon, sausages, German sausage, boar's head, ham, eggs, cod, salmon, herrings, kippers, butter, dripping, milk (fresh), milk (tinned), cheese, flour, golden syrup, jam, marmalade, brown sugar, onions, potatoes, rice, blue peas, haricot beans (dry and tinned), barley, oatmeal, lentils, tapioca, turnips, tinned tomatoes, currants, raisins, apples, rhubarb, mixed vegetables, tea, coffee, condiments (salt, pickles, &c.).

Atwater's standards and the dietaries of civilians, sailors, and soldiers in foreign armies are given on next page for the sake of comparison.

It will be seen from the last table that the peace dietary provided free of expense to the British army appears to be less than what is allowed to the French, and more than that allowed to the German armies. Compared with Atwater's standards it is less than the dietary of a man doing moderate work; and it. seems probable that by itself it would not be sufficient except at times when the work of the soldier is rather slack. This dietary is, however, nearly always supplemented by food bought for supper at the canteen or elsewhere ; and the pay of all soldiers is now sufficient to enable this to be done without hardship. The amount thus bought probably brings the average energy value of the food up to fully 4,000 calories, and at the same time gives elasticity to the diet, as each man can select the quality and amount of food which suits him. Experience seems to show that the arrangement of letting the men buy their own supper works on the whole smoothly, and is usually preferred, although sometimes supper is provided by the mess with advantage.

The Committee concluded from their enquiries that the recruit usually requires more food than the fully trained soldier ; for many of the newly enlisted are rapidly growing lads, and often after a period of unemployment before enlistment require good feeding to enable them to perform their duties in an efficient manner. This conclusion is supported by the fact that they buy considerable quantities of cakes, &c. The Committee note with satisfaction that the Army Council has now granted the messing allowance of 3d. per day to recruits, so that they can sufficiently supplement their provided rations without trenching too much on their pay.

Dietaries of civilians and others are quoted in the table for the sake of comparison, as some authorities have maintained that Atwater's standards err on the side of liberality. It should be noted that some of these dietaries represent the amount actually eaten, waste being deducted. The dietary for convicts in Scotland is, perhaps, of special interest, as it was fixed after careful observations by Dr. Dunlop of the effects of both a slightly higher and a slightly lower diet, and was the minimum found

	Protein	Fat	Carbo-hydrate	Calories	Remarks
Atwater's standards for men—	grms.	grms.	grms.		
No work	100	..	..	2,700	The amounts of fat and carbohydrate are not specified, but must together suffice, along with the protein, to make up the specified calories. The standards are for food actually eaten, no allowance being made for waste.
Light work	110	..	..	3,000	
Moderate work	125	..	..	3,500	
Hard work	150	..	..	4,500	
Very hard work	175	..	..	5,500	
Average food supplied gratis to the four British regiments given above	133	115	424	3,369	Waste included, but not food bought.
British soldiers in detention undergoing sentences exceeding forty-two days without hard labour (*a*)	127	65	497	3,272	Ration allowed.
British soldiers in detention undergoing sentences exceeding forty-two days with hard labour (*b*)	141	69	568	3,614	Ration allowed.
Average of fifteen college boarding clubs, United States (*b*)	107	148	459	3,690	Food eaten.
Members of two college football teams, United States (*b*)	225	334	633	6,812	Food eaten.
Members of five factory workers' (*b*) boarding houses, Massachusetts (*c*)	122	182	532	4,334	Food supplied.
Chinese agricultural labourers, California (*d*)	144	95	640	4,100	Food eaten. Waste = 205 calories.
Ordinary prisoners, Scotland, light work, mostly sedentary (*e*)	135	35	536	3,115	Food supplied.
Convicts, Scotland, "hard labour" (= moderate work) (*e*)	173	57	602	3,707	Food supplied.
Ordinary prisoners, England, "light labour" (*e*)	138	..	..	3,381	Food supplied.
Convicts, England, "hard labour" (*e*)	177	..	..	4,161	Food supplied.
Food supplied free, seamen, Royal Navy (*f*)	91	48	406	2,585	Seamen and boys are also allowed 4d. a day to buy the extra food required.
Food supplied free, boys, Royal Navy (*f*)	107	69	406	2,845	
Actual consumption of seamen, Royal Navy, exclusive of alcohol (*g*)	176	..	..	4,080	Food supplied free and bought, without allowance for waste.
French Army, normal peace ration (*h*)	125	60	573	3,426	*See* Appendix VI.
German Army, peace ration ..	144	56	500	3,161	,, ,, ,,
United States Army, peace ration	157	140	603	4,179	,, ,, ,,
Russian army, peace ration ..	155	57	648	4,080	,, ,, ,,

(*a*) "Allowance Regulations of the British Army," JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, 1908.

(*b*) Bulletin No. 75, Office of Experiments Station, United States Department of Agriculture, 1900.

(*c*) Bulletin No. 21, Office of Experiments Station, United States Department of Agriculture, 1895.

(*d*) Bulletin No. 107, Office of Experiments Station, United States Department of Agriculture, 1901.

(*e*) Dunlop Report on Prison Dietaries (C. 9,514), 1889; also *Scottish Medical and Surgical Journal*, 1901, p. 405.

(*f*) King's Regulations for the Navy and Admiralty Instructions.

(*g*) Calculated from data in Report of Navy Rations Committee (Ed. 782), 1901.

(*h*) Calculated according to Continental authorities. By Atwater's Tables the values would be somewhat higher.

to be capable of preventing loss of weight and complaints of insufficiency in men of average size. The so-called "hard labour" done by the convicts was much less than that done by a free labourer, and could only be classed as moderate work; yet the energy value of the food they required amounted to 3,700 calories. The food was good and wholesome, though of course of a much plainer kind than that provided for soldiers. Similar observations showed that for ordinary prisoners, with light work, mostly sedentary, a diet of 3,100 calories was about the minimum required. This corresponds closely with Atwater's data for professional men with mostly sedentary occupation.

It is a common mistake to suppose that, on an average, men eat more or less food according as they can afford it. The main determining factor is undoubtedly the amount of physical work they perform, and the soldier is no exception to this rule. If he is worked hard he must have more food, and in times of extra exertion certainly requires on an average more than 4,000 calories, to prevent gradual loss of strength and efficiency.

As the result of their enquiries, the Committee believe that, taking into account the extra food which the British soldier is now well able to buy when he requires it, he receives, during peace, sufficient food; and as far as could be judged from visits to Aldershot, Tidworth, Cardiff, Halifax, Newcastle-on-Tyne, Hounslow, and Reading, and the examination of the different articles given in the messing accounts, the quality and variety of food are satisfactory.

(II.) *The Quantity and Nature of the Food required by the Soldier during War. War Ration.*

Although the Committee have not especially investigated this question, it may be useful to compare the war rations of the British and foreign armies. This is not an easy matter, owing to the special allowances which may be made, and the following table must not be considered as rigidly exact.

The table shows that the war ration of the British army during the South African War was considerably less in energy value than the Russian and Japanese, and incidentally it proves that the popular idea that the Japanese consumed very little food is erroneous.

For men constantly engaged in marching and fighting a ration amounting to 3,900 calories would probably be insufficient unless supplemented from other sources. About 4,500 calories would be needed, to judge from available data. The amount of physical work done during war varies considerably, however, and possibly the British war ration, which has apparently been fixed as the result of considerable practical experience, would prove sufficient. On this point further observations of a more definite character than those at present available are, we think, needed.

War Rations of British and Foreign Armies.

	Protein	Fat	Carbo-hydrate	Calories
	Grammes	Grammes	Grammes	
British army (South Africa minimum) (*a*)	138	105	528	3,903
French army (*b*)	143	72	517	3,383[1]
		With soup bread		4,005
German army (war ration, "normal") (*b*)	118	68	411	2,801[2]
Russian army (Manchuria) (*b*)	187	27	775	4,891
Japanese army (Manchuria) (*b*)	158	27	840	4,343
United States of America (field ration) (*b*)	167	110	608	4,199

[1] The "normal" war ration in the French army amounts to 3,064 calories, the augmented ration 3,383 calories: with *pain de soupe* 250 grammes added, the calories become 3,686 and 4,005 respectively. The "normal ration" in both the French and German Armies is a ration which may be supplemented by whatever other articles of food the General Officer Commanding may authorise.

[2] The latest works on military hygiene in Germany draw attention to the insufficiency of the war ration, which it is said ought to contain 150 grammes protein, 100 grammes fat, and 500 grammes carbohydrate, giving 3,575 calories.

(*a*) An analysis of the Emergency Ration is given in Appendix V., but the Committee have made no experiments with it.

(*b*) *See* Appendix VI.

(III.) *The Compositon of Tinned Meats and the Influence of Preservatives.*

During active service in the field the soldier may have to depend largely upon preserved food, especially tinned meat. It is therefore important that the composition and quality of such food should be carefully examined. At the request of the Committee, Major W. W. O. Beveridge, D.S.O., R.A.M.C., has made numerous analyses of samples of tinned meat of different kinds. The detailed accounts of this investigation are given in the Appendix to this report; here only the chief results and conclusions will be mentioned.

The table on p. 678 relates to the average composition of tinned meats.

The Committee have already drawn the attention of the Army Council to the inferior quality of the meat referred to in the report of the analyses by Major Beveridge. They understand from a communication from the Director of Supplies that in future the manufacture of tinned meat in the United States of America will be under the supervision of the Supply Branch of the Army, and that in the British Colonies only the firms which prepare the best articles will receive contracts.

The Committee tested upon themselves the taste and quality of various brands of tinned meat, and found that there were considerable variations, some being good and others inferior. In regard to the amount of fat, they consider that meat with less than about 10, or more than about 15 per cent. of fat, is unpalatable to most men.

TABLE TO SHOW THE AVERAGE COMPOSITION OF TINNED MEATS.
(*From analyses made by Major W. W. O. Beveridge, R.A.M.C.*)

Nature of sample	No. of tins analysed	No. of analyses	—	Water	Ash	Total Nitrogen	Protein, N. × 6·25.	Fat.	Calories
									per lb.
Corned Beef ..	19	70	[1] Maximum	58·64	5·00	5·30	33·56	60·2	2,691[2]
			[1] Minimum	22·93	1·67	2·34	14·63	6·96	903
			Average ..	51·05	3·56	4·44	28·72	17·74	1,282
Roast Beef ..	12	14	Maximum	71·05	5·02	5·43	33·94	36·67	1,526
			Minimum	38·32	1·99	1·85	11·56	5·37	762[3]
			Average ..	58·23	3·22	4·28	26·75	12·99	1,042
Roast Mutton ..	7	9	Maximum	53·74	2·75	5·22	32·63	34·32	1,670
			Minimum	38·39	0·41	3·18	19·88	21·13	1,398
			Average ..	46·22	1·52	4·24	26·50	25·74	1,578
Corned Mutton	9	24	Maximum	59·22	3·76	5·35	33·44	42·19	2,064
			Minimum	29·15	1·26	2·32	14·50	12·66	1,354
			Average ..	43·05	2·39	4·21	26·34	28·12	1,601

[1] Maximum and minimum refer to the entire number of tins in each ration.
[2] In this case the fat = 60·29 per cent.
[3] In this case the fat = 5·37 per cent.

The question as to the reason why tins of meat, after passing the tests applied by the makers, become suddenly blown after keeping good for months, or may be years, has not until now been satisfactorily explained. If due to minute punctures from rusting or damage, allowing air to enter, one might suppose that the resulting gas of putrefaction would also escape, and blowing of the tin would not be apparent, but on the other hand the leak might be blocked as the gas accumulated.

The blowing is probably caused by the development of spores of bacilli, such as *Bacillus cadaveris*, which were present in the meat at the time of packing and were not destroyed by sterilisation, the heat of sterilisation having been insufficient to penetrate to the centre of the meat in the tin.

From experiments made for the Committee by Major Beveridge and Captain Fawcus, the following facts were made clear:—

(1) The rate of penetration of heat into the substance of the meat in tins during sterilisation is extremely variable. To ensure complete sterilisation the temperature of the medium surrounding the tins must always be above 112° C. (233·6° F.). The lowest temperature of the surrounding fluid which will completely sterilise the tins within a reasonable time is 120° C. (248° F.), and this temperature must act for not less than sixty minutes.

(2) The bacillis (*B. cadaveris*) isolated from the decomposed food, though non-pathogenic to animals, decomposes tinned meats and renders them quite unfit for consumption. For this reason processes of sterilisation of tins of meat must be used which will destroy the spores of this

organism. The optimum temperature for the growth of this bacillus is 37° C. (98·6° F.). At this temperature inoculated tins of meat become rapidly decomposed, but the condition is not necessarily made apparent at once by the presence of gas. Blowing of the tins often does not take place within a fortnight even at this temperature. Tins of meat contaminated with the spores of this bacillus could be kept at or below a temperature of 22° C. (71·6° F.) for many months without showing signs of blowing. If, however, such contaminated tins, although apparently sound when examined in this country, were exposed to a temperature such as is likely to be met with in the Tropics, they would rapidly become decomposed.

The tables of analyses on p. 670 made by Major Beveridge show that the amounts of metal found in the tins were not enough to cause injurious effects.

No boracic acid or other preservative was found in the tinned meat. In some cases the amount of nitrate from the pickling fluid was excessive, and its ingestion would probably cause gastric disorder.

The nature and significance of "can-burn" has been carefully investigated by Major Beveridge. The results show that sulphide of tin, sulphide of iron, and oleate of iron are present in the deposit.

The weights of the tins of preserved meat have varied considerably in the different brands, and the Committee think that there should be, as at present, a definite relation between the weight of the tin and the weight of its contents, irrespective of whether the weight of the latter is "nominal" or "actual." For convenience of transport by the soldier, and for ensuring a supply of food to each man, the issue of 1 lb. tins would appear to be desirable.

The present practice of dating the tins should be continued, and no paper labels should be allowed.

(IV.) *Messing Arrangements.*

The Committee have seen the arrangements for messing in different depôts and regiments, and consider that the restaurant system of messing has had a considerable measure of success in depôts, but are not convinced of its applicability to regiments and battalions under present conditions. The Committee think that the use of separate dining rooms is excellent, for the standard of comfort has been raised in all classes of the population. They would like to see provision made for the men to obtain beer, mineral waters, or water at their dinner. This practice has been tried successfully in some regiments, and has been much appreciated by the men.

Master-cooks are not allowed on the establishment of depôts, and it is a matter of chance whether there is a trained cook or not. This appears to be unsatisfactory, especially in the case of men undergoing training, to whom sound digestion of food is important. It is most desirable that this deficiency should in future be removed.

TABLE OF METALS FOUND. ESTIMATED ON THE WHOLE CONTENTS.

No. of sample	Age of sample	Condition of interior of the tins	Average weight of contents of tins in grammes	Acidity as lactic acid, grammes per cent.	Iron		Tin		Zinc	
					Grammes per cent., average 3 tins	Average amount per tin, grammes	Grammes per cent., average 3 tins	Average amount per tin, grammes	Grammes per cent., average 3 tins	Average amount per tin, grammes
1	1 year 3 months..	Bright. Slight rust in places	385	0·45	0·120	0·460	..	..	..	..
2	10 months	Blackened	377	0·45	0·817	3·090	..	..	..	..
3	1 year 9 months..	Three blackened and three bright ..	780	..	0 046	0·358	..	..	..	..
4	5 years 7 months	Blackened in places	2,821	0·45	0·070	1·890	..	..	..	..
5A	2 years 4 months	Fairly bright	911	0·63	0·040	0·364	Traces	0·0003	0·0085	0·004
5B	2 years 4 months	Tin blown, slight blackening	911	1·62	0·005	0·044	..	..	..	..
6	2 years 10 months	Slightly blackened	737	0·44	0·009	0·066	..	..	..	..
7	2 years	Blackened	766	0·63	0·210	1·600	..	..	..	..
8A	2 months.. ..	Much blackened	822	0·45	Traces	..	..	..	..	..
8B	2 months.. ..	Blackened in places	822	0·63	Traces	..	..	..	..	..
9	3 months.. ..	Blackened	381	0·54	0·087	0·331	..	..	..	..
9A	3 months.. ..	Much blackened. Much solder in seams	381	0·45	0·37	1·409	..	..	..	..
9B	3 months.. ..	Slightly blackened..	381	0·45	0·15	0·571	..	..	..	..
10	2 years 11 months	Somewhat blackened	427	0·47	0·15	0·640	..	..	..	..
11	1 month	Bright	780	0·63	0·114	0·890	0·0043	0·033	Traces	..
12	3 months.. ..	Bright, some red discoloration ..	340	0·26	0·260	0·884	0·0009	0·003	0·018	0·060
13	3 years 3 months	Bright, some black and red discoloration	440	0·42	0·090	0.396	*Nil*	..	0·005	0·022
14	4 months	Much blackened	740	0·56	0·40	2·96	0 012	0·089	0·008	0·059
15	3 years	Much blackened, corroded in places ..	703	0 33	0·100	0·703	0·004	0·028	0·010	0·070
16	1 year 9 months..	Fairly bright	373	0·45	0·30	1·119	0·0002	0·0007	0·0063	0·023
17	10 months	Bright	500	0·27	0·074	0·370	..	..	..	..
18	3 months	Fairly bright	867	0·36	0·220	1·907	0·004	0·034	0·0135	0·117
19	3 years 3 months	Much blackened	370	0·63	0 100	0·370	0·001	0·003	0·013	0·048
20	5 months	Not much blackened	737	0·54	0·310	2·284	0·010	0·073	0·009	0·068
21	1 year 3 months..	Much blackened	385	0·36	0·233	0·897	0·0026	0·010	0·042	0·161
22	3 years 4 months..	Much blackened	895	0·36	0·310	2·774	..	..	..	..

(V.) *Conclusions and Recommendations.*

The Committee have come to the following conclusions:—

(1) That the soldier, both the recruit and the trained man, now receives sufficient food during peace, and the quality and the variety of the food are generally satisfactory.

(2) That the ration allowed during the South African War represents a reasonable basis for formulating a ration for active service in the field, but that further investigations on this point are needed.

(3) That the supply of tinned meat requires careful supervision, for some of the brands contained meat of inferior quality.

(4) That the blowing of tins of tinned meat is due to the development of spores of bacteria, which were present in the meat at the time of packing, and were not destroyed by sterilisation. The lowest temperature of the surrounding fluid which will completely sterilise the tins within a reasonable time is 120° C. (248° F.), and this temperature must act for not less than sixty minutes.

(5) That the amount of fat in tinned meat should be 10 to 15 per cent.

The Committee beg to make the following recommendations:—

(1) That the preparation of tinned meat should continue to receive, as at present, careful supervision at the hands of the Supply Branch of the Army.

(2) That there should be a definite relation between the weight of a tin and the weight of its contents, irrespective of whether the weight of the latter is "nominal" or "actual."

(3) That the present practice of dating the tins should be continued; that the tins should be painted, not lacquered, and that no paper labels should be allowed.

(4) That sample tins should be examined after they have been incubated for a fortnight at 37° C.

(5) That provision be made for men to obtain beer, mineral waters, or water at their dinner.

(6) That experimental observations of a definite character should be made to determine what is a sufficient ration for active service.

(7) That the question of the improvement of cooking at depôts should be considered.

(To be continued.)

THE SECOND INTERNATIONAL CONGRESS ON SCHOOL HYGIENE, LONDON, 1907.

By Lieutenant-Colonel A. M. DAVIES.
Royal Army Medical Corps (R.).

(*Continued from p.* 474).

Section V. discussed *Physical Education and Training in Personal Hygiene.* The President, Sir John Byers, considered that physical training could best be carried out by (*a*) the Swedish methods, which tend to develop groups of correlated muscles; (*b*) gymnastic exercises and musical drill at the schools, and dancing for girls; (*c*) open-air games in school playgrounds or athletic fields; and (*d*) by swimming. "Sloyd" was explained by Mr. Mikkelsen, of Copenhagen; the Swedish system by Lieutenant F. H. Grenfell, R.N., and "ju-jitsu" by Mrs. Roger Watts (with practical demonstrations by pupils, who threw each other about in the large hall of the University, under her guidance, in the most entertaining manner). In the discussion, Commander Hugh Watson, R.N., Superintendent of Physical Training in the Royal Navy, and Major Charles Moore, Assistant Inspector of Army Gymnasia, both referred to the confusion that existed in many people's minds with regard to the terms "gymnastics," "physical training," and "drill." By "gymnastics" is often understood "acrobatics," or gymnastic tricks: this sort of exercise is certainly not required by children, or by young soldiers and sailors in their training. Neither is "drill" any part of the "physical training" of the sailor or soldier, except for the sake of discipline and handling classes. "Physical training," as now carried on in the Army and Navy, is a building up of physique and carriage, the formation of alert qualities of mind and body, not an acrobatic muscle-creating specialism, but something having for its object a healthily formed, all-round active individual, and intended for the average, and not for the expert or particularly strong. The term "physical exercise" is applied to the exercise of the men (over 21 years of age) already built up by "physical training" in regard to carriage, physique, &c.; in this all forms of athleticism are combined. Both officers heartily agreed with the principles that underlie the Swedish system. Dr. J. G. Kerr, of Glasgow, and Miss Palmer, of Leith, spoke as to the very beneficial effects of interpolating brisk exercise for a few minutes in the middle of a class lesson; a refreshing or recreative result had been invariably obtained.

The subjects dealt with in Section VI., *Out of School Hygiene*, and Sections VIII. and IX., *Special Schools* for feeble-minded children and the blind, deaf and dumb, do not call for consideration in this report. Nor does that of the *Hygiene of Residential Schools* (Section X.): except that allusion must be made to the very important Record of the Physical

Examination of Boys, contributed by Dr. Clement Dukes, of Rugby, the President of the Section. These boys were those who entered Rugby School from January 21st, 1899, until May 6th, 1907; they formed a consecutive thousand entries, without any selection: the record is being continued. Dr. Dukes used as his standard of comparison the table compiled by Dr. Charles Roberts, based on observations on 7,709 boys and men between 10 and 30 years of age, "of the most favoured classes of the English population—public school boys, naval and military cadets, medical and University students." The most surprising points in Dr. Dukes' figures were that 445 out of the 1,000 boys "of the most favoured class" had lateral curvature of the spine; and that 526 were knock-kneed, 157 suffered from albuminuria, and 70 were stammerers. A resolution was passed in this Section that "it is desirable that all secondary schools should be subjected to inspection in matters relating to hygiene and sanitation."

Contagious Diseases, Ill-health and other Conditions affecting Attendance were discussed in Section VII., which was very fully attended, under the presidency of Sir Shirley Murphy. In his opening remarks Sir Shirley alluded to the difficulties which have stood in the way of organised administrative effort in London, until lately, owing to the separation that had existed between the Education and the Health Authorities: as evidence of which he adduced the diphtheria epidemic prevailing in the six years, 1892 to 1897, during which some 15,000 children lost their lives. The Health Authority in England is now constituted the Education Authority, and this has in it the basis of an effective machine. "The guiding principle must be that the administration, which is designed to protect the health of the population 'at all ages,' is that which must be concerned with the health of the child at school age, whether in the school or in the home." In answer to the question, to what extent school attendance contributes to the number of cases of infectious disease in a population, Sir Shirley compared the actual number of cases of scarlet fever and diphtheria that occurred in August (when the schools were closed) during the ten years, 1895 to 1904, with the number that would have occurred if the schools had been kept open; this figure being estimated from the actual notifications in June, July, September and October. The difference between the actual and the estimated cases is, in respect of scarlet fever, 3,974, or 27·6 per cent., and in respect of diphtheria, 2,002, or 23·3 per cent. Sir Shirley dealt with criticisms that might be made on these figures, and stated his belief to be that they do really represent substantially a decrease, as the result of the holiday school closure. As to the relative efficacy of exclusion of particular scholars, or closing of classes or entire schools: in regard to diphtheria he hoped that where bacteriological procedure could be employed "the complete examination of material from the throats

of the children attending an invaded school, and the exclusion of all harbouring the Klebs-Loeffler bacillus may suffice, without the more extreme step of closing the class or the school": but further experience is needed. In view of the special incidence of infectious disease upon children in the first few years of life, the question of the age at which they should be required to attend school is of importance. In England this age is 5 years, in Germany it is one year later. It is to be borne in mind that if the age of the attack be deferred, the result will be a lessening of the fatality of the disease; therefore, if postponement of age of attendance at school leads to postponement of age of attack, the result will be a saving of child life. In regard to tuberculosis, Sir Shirley conjectured that "infection by ingestion must increasingly be regarded as an important factor." He concluded by mentioning the great advantage that would result to the general population if all children suffering from contagious maladies, such as parasitic skin disease, trachoma, pediculosis, &c.—conditions which ought not to be tolerated in a civilised community—were systematically treated.

Dr. James Niven dealt at length with the *prevalence of diphtheria* in the Manchester schools, as shown by statistics of the decennium, 1897 to 1906, referring to an average of about 100,000 children. The year of maximum incidence was found to be the fourth year of life; a small decline occurs in the fifth year, and a marked drop at the age of 6. The year of maximum incidence, therefore, precedes the years of school life, but it is the year in which children are first brought into intimate contact with each other in the course of out-of-door play; the drop at the age of 6 is probably due to the widespread establishment of immunity. Dr. Niven alluded to the two forms of school diphtheria, a low and steady persistence, and a special outburst, or "flare-up"; the former is greatly influenced by the number of scholars and the amount of the disease present in the district; "flare-ups," constituting the true "school influence," are due to "the aggregation of susceptible children in the infant departments of the schools affected, subjected to some particular cause of a temporary character," probably the presence of some child or children with copious discharges, rich in diphtheria bacilli, while they are themselves not suffering. The sanitary condition of the schools appears to have little to do with the occurrence of these outbreaks. Reviewing the whole question, Dr. Niven believes that "diphtheria finds in the earlier period of school life a favourable occasion to extend itself, and that in fact it is in this manner widely diffused." As regards the bacteriology of the disease, he suggests that the "short" or "suspicious" bacillus is frequently a true diphtheria bacillus, and that in all probability the so-called Hofmann bacillus has frequently been a diphtheria bacillus; also that there appears to be a considerable margin of doubtful forms: all these may be harboured by children and may produce immunity; "the

facts seem to point to a widespread production of immunity, especially in the poorest districts, through bacilli of comparatively low virulence."

Dr. Niven concluded with a description of the procedure adopted in Manchester schools on the occurrence of a case or cases of the disease, the endeavour being made to adopt "complete measures" of diagnosis and prophylaxis, the necessary medical assistance required to carry this out being obtained.

Scarlet fever prevalence amongst school children was dealt with by Dr. T. H. C. Stevenson. Little account need be taken of the child's age in scarlet fever (in contrast with measles) in relation to protection by previous attack. The incubation period is commonly five days or less; the infectivity is greatest within the first day or two of illness; and though spread may occur by "return" cases, by imperfect isolation of previous cases, and by indirect infection, "it may well be that the great majority of cases infected in the school and street are due to 'missed cases,' and perhaps partly to 'carrier cases.' It is no novel conclusion that the control of scarlet fever is very largely a matter of the detection of missed cases, the difficulty is to see how this can be secured."

In dealing with the *problem of Ill-health and School Attendance*, Dr. Poynton advised that all cases of sore throat should be excluded until they are well: he drew particular attention to the importance of rheumatic affections in childhood, advancing four main considerations: (1) That children of rheumatic parents are excitable, nervous, easily over-tired, subject to night terrors and headaches, and in need of watchfulness on the part of the teacher: (2) the danger attending the condition when untreated by rest; early heart disease is singularly free from pain; headache, irritability and the irregular movements of early chorea are put down to naughtiness or carelessness, and valuable time in the treatment is lost: (3) the stubborn and relapsing character of the disease: convalescent homes for rheumatic children, where they can have complete rest, are sorely needed: (4) when a child has recovered from the acute rheumatic attack the heart is more or less damaged; these children must be educated, but they are delicate and need careful management. The management of epileptic children is a very difficult matter: Dr. Poynton looks for "an intelligent co-operation between parents, school teachers and medical men, coupled with the cautious trial of special schools for the large class of epileptics that lie between the very mild and very severe types."

Dr. Newsholme returned to the subject of the *Lower Limit of Age for School Attendance*, on which his views, set forth before the Childhood Society in 1902, "that the attendance at school of children under 5 years of age should be prohibited, as it involves unnecessary and serious risk to health, is educationally worthless, and is contrary to the interests of public economy," are well known, have met with wide acceptance, and have been practically endorsed by Mr. Cyril Jackson, Chief Inspector of

Public Elementary Schools, and by the Board of Education, in their "Suggestions for the Consideration of Teachers" (1905); though Dr. Kerr dissents. According to the present Code, the Local Educational Authority has complete discretion as to admitting or excluding children under 5 years of age. (By paragraph 59, Army School Regulations, 1906, children of 4 years of age may be admitted to the army infants' school for the morning session only). Dr. Newsholme hopes that in future Codes "the teaching of reading from books, or writing on slates or paper, will be specifically prohibited for children under 5, or, better still, under 6 years of age. At such ages injury to the undeveloped eye almost necessarily results from attempting to do near and fine work." Two other dangers are: (1) The general effects of breathing polluted air; and, in particular, (2) the occurrence of communicable diseases. The evils of aggregation are not sufficiently acknowledged; schools necessarily involve aggregation, and scholars depend on it for a large part of their social education; aggregation, however, causes physical mischief to the child, and this risk is greater, and the social education less, with young children than with their elders. The amount of floor space is too small; the classes are too large. Increase of floor space for each child and diminution of size of classes evidently involves serious economical considerations; but the additional expense would probably "be almost met by economising on the unnecessary and educationally useless accommodation now devoted to children under 5." The atmosphere of an average schoolroom is fouler than that of the average house of the poor; "so far as their life during the day is concerned the vast majority of children attending elementary schools are under more favourable conditions at home than at school." To the difficulties of ventilation must be added "the nuisance arising from the aggregation of such a large amount of clothing, much of which is impregnated with organic matter, and is too seldom washed or renewed." With regard to infectious diseases, "after 6 years of age the attack-rate of both measles and whooping cough rapidly declines, and the fatality among those attacked becomes relatively small after the age of 5. Obviously, therefore, there is great advantage to children in postponing the age at which attack, if any, of these diseases occurs; for not only is a later attack less likely to be fatal, but as Whitelegge has shown for scarlet fever—and probably the same rule applies for other infectious diseases — postponement of an attack diminishes the likelihood of subsequent attack."

Dr. Newsholme gave statistics of 596 cases of measles and their relationship to school life: "one-third of the total children aged 3 to 5 in Brighton attend elementary school; amongst these nine-tenths of the primary cases of measles occurred." Even if a large allowance be made for more complete notification of cases among scholars, he thought it certain that school attendance greatly increases the risk at these ages. Dr. Newsholme concluded that "experience in administration always

shows that attendance at school increases the risk of importation of infection into houses"; and that there is a high probability that "if children were not admitted to school until after 5 years of age the results would be that (*a*) fewer families would become infected; and (*b*) the children of those families still becoming infected would be infected on the average at a higher age, with the result that fewer deaths would occur." As an interim reform he put forward the suggestion of Mr. Hackforth, Clerk to the Brighton Education Committee, that the Board of Education should allow the number of school meetings during the year to be entered separately: (1) for children over 5; and (2) for children under 5; and for each of these to be divided into the corresponding total number of attendances in order to obtain a separate average attendance for children over and under 5. Then there would be no loss of grant if the younger children were excluded from school meetings which the elder children were allowed to attend.

A good discussion followed on this paper. Dr. A. H. Hogarth traversed Dr. Newsholme's arguments, and submitted that the remedy for existing evils in the infants' schools lies, not in the exclusion of infants, but in the improvement of the conditions of schools. He laid down four essentials for an infants' school or kindergarten: (1) Suitable curriculum in accordance with physiological requirements of infant life; (2) hygienic surroundings; (3) teachers with special aptitude and training; (4) some medical supervision. He urged that we are doing a great service to every child in placing it for four hours every day in clean and wholesome surroundings. Dr. Franklin Parsons supported Dr. Newsholme. He believed medical officers of health generally were against the attendance at school of children under 5; he himself thought that the child would generally be better under the care of its mother than in school. Mrs. Kirk, of Bradford, and Miss Adler, of London, believed that attendance in school was beneficial. Dr. Cuntz, of Wiesbaden, was surprised to find infants under 5 attending school; in Germany it is strictly forbidden by law to admit children under 6 years to public schools, and even up to 6½ the child will be rejected if its health is unsatisfactory. Dr. Cronin, of New York, said that a child under 6 was not admitted to New York schools, and not compelled to go until 8 years of age. Miss Adler, Mr. Abel, and others spoke of the good effects of *crèches* or kindergarten schools, as at Nottingham and elsewhere. Although no resolution was adopted, either for or against Dr. Newsholme's proposal, the general sense of the meeting, which was fully attended, appeared to be somewhat adverse; but the establishment of *crèches* was regarded with favour.

Drs. Sidney Davies and C. J. Thomas contributed two papers relating to the *Effect of Early School Closing on the Prevalence of Measles:* the procedure and results obtained in the Borough of Woolwich were described. Here, during the four years 1903-1906, it was arranged in one-half of the borough to close any class in the infants' department of an elementary

school immediately a case of measles was notified; in the other half, only to adopt the ordinary measure of excluding children from infected homes. The result of this enquiry was to show that in the long run school closure had little effect upon the spread of the disease. The chief conclusions arrived at were as follows: When introduced into a class, measles will spread with a rapidity proportional to the number of non-protected children attending, if the class continues to assemble. The first crop of cases will occur in about twelve days after the first case, and in about twelve days more the majority of unprotected children will have been attacked. Closure, therefore, to be effectual, must occur within ten days of the first attendance of the first infectious case; but early notification of the first case is not usually to be obtained. Even when closure is effectual in keeping out measles for a time, the rate of spread, when introduced, will increase proportionally, and it will not be possible to postpone an outbreak for long. School closure, therefore, as generally applied, is futile as a preventive measure; with the present available means it cannot be applied with sufficient success to make it desirable, or to be recommended, in view of the loss of school attendance, and annoyance caused to parents and teachers. The great majority of children only have one attack, and the infection is not likely to be carried by a third person. Lastly, when two-thirds of a class are protected by a previous attack, measles is not likely to spread, even if introduced; and measles contacts in the class, who have had measles themselves, need not be excluded from school. The authors therefore consider that the regulations as to measles prevention should be revised; they believe that education of the parents, by leaflets of instruction as to symptoms and the need for care, which may also be given by health visitors, has the effect of greatly reducing the mortality from this disease.

The prevalence of *Tuberculosis amongst School Children* was the subject of a paper by Dr. Edward Squire and Dr. Annie Gowdey, who found, on an examination of two London schools, that out of 1,670 children, signs in the lungs which would justify a diagnosis of tubercle were present in only eight cases, or less than 0·5 per cent.; in fourteen other children slight physical signs were found, possibly due to tuberculous infection: even if these were included, the possibly pulmonary tuberculosis cases only amounted to 1·3 per cent. Drs. Lecky and Horton examined 806 children in a parochial industrial school, a workhouse and infirmary, and an elementary day school; the total number of cases of "revealed tuberculosis" (pulmonary) was only three, or 0·37 per cent. Dr. Kelynack adduced some statistics gathered from various sources, and all tending to the same conclusion, that "open" or "revealed" tuberculosis is uncommon in school children; but in his opinion "the returns at present available considerably underestimate the extent of tuberculous disease in our schools."

The *Ringworm* question in schools was considered in four papers in

this Section. Drs. Meredith Richards and Winifred Thorp described the procedure at Croydon, where excellent results have followed the plan that has been adopted, viz., exclusion of affected children from school, accompanied by their treatment at the public expense. Ringworm of the *body* is treated by drugs, a cure may be effected in seven days, but actually the average time is about two and a half weeks. For ringworm of the *scalp* X-ray treatment is employed (1) for chronic cases with more than one patch; (2) for children whose parents are too busy or too neglectful to carry out drug treatment efficiently; (3) for children in higher standards, whose time is valuable, and who are working for scholarship examinations. Drug treatment is employed (1) for all recent cases; (2) for children under 5 years; (3) when parents object to X-rays. The average time for a cure by X-rays has been eight weeks; by drugs thirteen weeks; but the two sets of cases are not fairly comparable.

Section XI. discussed the *School Building and its Equipment*, under the presidency of Mr. T. E. Collcutt, F.R.I.B.A., who, in his introductory remarks, urged that in every school building, however simple in general construction, there should be at least one feature of architectural worth, such as a fine doorway; a fine example in stone or woodwork might prove of great educational value to their budding craftsmen. He protested against the use of glazed surfaces, such as tiles, in school and class-rooms, which he considered depressing, as was the case also with the cold and drab colours so commonly used. He alluded to the ventilation problem, inclining to the open fireplace and open window; it was desirable, as a matter of example, that children should see that frequent changing of the atmosphere was insisted on in the class-room. "No patent system of ventilation would teach them the valuable lesson they might learn by seeing the importance of having the windows open."

The provision of daylight, and the measurement of the quantity supplied, were dealt with in a technical manner by Messrs. Pleier, of Karlsbad; Ruzicka, of Prague; Selter, of Bonn; and Quirsfeld, of Rumburg. Mr. Ainslie Walker, F.C.S., read a short practical paper on *Disinfection* (not printed), in which he drew attention to the dangers of dry sweeping, and rightly stated that spraying with a disinfectant solution is what is really needed as a routine practice. Dr. George Reid shortly described the *Staffordshire type of Elementary School*, which is designed on the pavilion principle, with detached central hall serving the three school departments, the communication between classrooms and with the central hall being by means of verandahs. There are windows on each side of the classrooms. "They are ordinary sash windows, but connected with each is an arrangement by which, when the lower sash is raised, a fixed hopper opening is formed, extending across the whole width of the window, the actual opening being governed by the height to which the sash is raised." The classrooms are heated by low pressure

water circuit with radiators, and to compensate for the free ventilation, the mean heating surface is on the somewhat liberal scale of 19 superficial feet per 1,000 cubic feet of space. Dr. Reid stated that with this arrangement there appears to be no need for other specially constructed ventilation openings, either in the ceiling or elsewhere; he also stated that, as regards the lighting, there does not seem to be any objection to providing windows on opposite sides of the classroom.[1] The cost works out at from £10 10s. to £11 1s. per head, as compared with £15 per head for the central hall type. The Board of Education have approved of the "Staffordshire" type of school.

Other papers on construction, ventilation, and lighting were read by Mr. Topham Forrest, Mr. Nelson Haden, and Mr. David Barclay, but without the contribution of any suggestions comparable in importance to those of Dr. Reid. Mr. Haden stated that, in the plenum system, "if carefully designed," the windows can be opened without detriment to ventilation. This is not what is generally laid down by the advocates of this system; Mr. Barclay, on the other hand, considers it an advantage that the windows are kept shut, because it minimises the noises in the street, which are often a source of annoyance.

On the whole, the difficult subjects of lighting, ventilation and warming of schoolrooms can hardly be said to have been much advanced, either by the papers or the discussions in this Section, except for Dr. Reid's important contribution.

Conclusion.

The Congress was well attended, the members exceeding 1,600 in number: it was a representative gathering of public men interested in education, of educational experts, of medical men, architects, and engineers, coming from all the countries of Europe, from India, Persia, Japan, Egypt, most of the British Colonies, the United States, and some of the South American Republics. Most of the discussions were followed with interest; abstracts of papers were generally, though not always, to be obtained; and the Congress may be said without hesitation to have been a genuine success.

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[1] Plans and sections of this type of school building are not furnished in the *Transactions* of the Congress, but are to be seen in the *British Medical Journal*, October 31 1908

Reviews.

GUNSHOT WOUNDS. By C. G. Spencer, M.B.Lond., F.R.C.S.Eng., Major, R.A.M.C., Professor of Military Surgery, Royal Army Medical College. London: Henry Frowde; Hodder and Stoughton. 1908. Pp. xii. and 287.

This book supplies a long-felt want; it brings the subject up-to-date in a concise manner and will be found most useful, not only to the student of military surgery, but to all who may have to treat these injuries. As the author points out, surgery in the field is, in fact, surgery *in arduis*, and the surgeon must often do the best he can with limited resources. This book, by giving sound practical advice, will greatly aid him in how to do that best, both for the time and for the subsequent welfare of the case.

All the chapters are excellent, but we would like specially to bring to notice those on wounds of the abdomen, head, spine, and blood-vessels. In the past to know when to operate on penetrating wounds of the abdomen has been a cause of the greatest anxiety to the surgeon in the field. Major Spencer shows clearly the best procedure to be adopted in these cases. Again, in dealing with wounds of blood-vessels most lucid advice is given as to their immediate and subsequent treatment, and the vexed question as to when to perform amputation is carefully weighed, and the *pros* and *cons* laid down as clearly as can be done in a class of injury where each case has often to be judged on its own merits.

The chapter too, on the mechanics of projectiles is a valuable contribution, and explains how the change in the majority of gunshot wounds is produced.

There is an interesting table showing at a glance the characteristics of the magazine rifles of small calibre of the different Powers. The important points in military surgery brought to light in recent campaigns have been made use of, and their practical bearing described. There are numerous excellent and helpful plates and figures, and due importance has been given to the value of X-rays. The book is well indexed, is easy reading, and of a handy size—an important point for Army Medical Officers.

C. B. L.

NAVAL SUPREMACY. WHO—ENGLAND OR GERMANY? AMERICA OR JAPAN? By A. M. Laubeuf (late Chief Engineer of the French Navy). Introduction by Fred. T. Jane. London: Siegle, Hill and Co., 1908. Pp. xvi. and 96 1s. nett.

This small pamphlet by M. Laubeuf, with an introduction by Mr. F. T. Jane, the well-known expert on naval questions, has only a general interest for medical readers.

M. Laubeuf, who is a leading authority on submarines, writes with a distinctly Anglophobe basis, but distributes his criticisms with considerable impartiality amongst the four nations of whom he treats.

The pamphlet, which is written in incisive style, should certainly be read by all those interested in international naval questions.

O. L. R.

A Dictionary of Medical Treatment for Students and Junior Practitioners. By Arthur Latham, M.A., M.D.Oxon., M.A.Cantab., F.R.C.P.Lond. London: J. and A. Churchill, 1908. Pp. vi. and 325. Price 6s. 6d. nett.

This little book, as stated in the preface, has been written in response to an invitation by the publishers, and is intended for students and junior practitioners. It is clearly and simply written, and contains within a small compass a large amount of information. Senior students and house physicians should find it a useful companion to systematic works on medicine in which the subject of treatment is sometimes inadequately treated.

In addition to ordinary medical treatment there are special sections on the Schott-Nauheim method, Fränkel's exercises, and vaccine therapy, the latter being an excellent brief summary of present knowledge.

The difficulties of writing such a book as the one now under review must be great, and it is, perhaps, ungrateful to offer criticism when the object aimed at has been so well attained, but we may mention the section on infant feeding as perhaps not attaining the high standard of the other articles. The babies for whom sole and powdered chicken are recommended would probably not receive these articles of diet if their parents belonged to the class usually met with in the out-patient department of a large hospital, and to whom the senior students' and junior practitioners' efforts would probably be directed. On the whole this is an excellent little book, and we wish it all success. O. L. R.

Tuberculin in Diagnosis and Treatment. By Bandelier and Roepke. London: John Bale, Sons and Danielsson, Limited, 1909. Pp. viii. and 182. Price 7s. 6d. nett. (Translated from the second German edition by E. C. Morland.)

This book, to quote from the preface by the translator, "gives in clear-cut outline a picture of the position of tuberculin in German medical practice at the present day," and it should be of very great service to all those who wish to get some clear idea of the thousand and one details which have been elaborated for the use of tuberculin in the diagnosis and treatment of tuberculosis, especially of the lung. The first part of the book is devoted to the use of tuberculin in diagnosis, and in this the authors enters into elaborate detail concerning the cutaneous, ocular and subcutaneous methods. For the cutaneous (von Pirquet's) reaction they recommend the use of undiluted old tuberculin in adults, and a 25 per cent. dilution in children. Three scarifications are made with a vaccinating lancet on the anterior surface of the forearm, the scratching going just short of drawing blood. On the upper and lower of the three scratches a drop of old tuberculin is rubbed, the middle mark remaining as a control. In the case of a positive reaction an area of inflammation appears at the inoculated spots, varying in size, as a rule, from 10 to 12 mm. in diameter; reactions under 5 mm. in diameter are to be considered doubtful. This method is recommended as being eminently safe and reliable; the modification which is recommended by Moro, and which consists in the inunction of an ointment containing 50 per cent. of old tuberculin in lanolin, suffers from the defect that it will only produce a reaction in about 50 per cent. of cases of tubercle. But it has its uses

in the diagnosis of tubercle of the skin in which the reaction after von Pirquet's test is apt to be inconveniently severe. For the conjunctival reaction the authors recommend the use of a 1 per cent. solution of the old tuberculin in saline, followed by 2 per cent. and 4 per cent. solutions in the same eye if the first instillation gives a negative result. For children the solutions recommended are a $\frac{1}{2}$ per cent. and a 1 per cent. The reaction appears in from six to twenty-four hours, or it may be delayed for a day or so. The authors warn especially against the use of the ocular test in cases where there is any disease of the eye, and, taking it generally, they prefer the cutaneous method as safer. They point out, quite justly, that a reaction by either of these methods only shows that there is tubercle somewhere in the body and gives no clue to its site or condition. For this reason they prefer the subcutaneous use of the old tuberculin as a diagnostic method, as it not only shows that tubercle is present but, by the reaction at the site of infection, shows its location and to some extent its area. The doses recommended are $\frac{2}{10}$ milligramme for the first dose, followed by 1 milligramme, 5 milligrammes and 10 milligrammes if the first doses do not cause a reaction. If a slight reaction is produced by a certain dose this same dose is repeated. The temperature is taken at intervals of three hours after the injection, and a rise of temperature above 37·3° in the mouth is considered as a positive reaction; it is obvious that this method is not applicable to patients who already have fever. At the site of infection there is an increase of the local signs, *e.g.*, increase of râles in cases of phthisis. According to the authors the method is safe if proper precautions are taken, and their experience entitles them to a respectful hearing, although in this country it is considered, chiefly on theoretical grounds, that the hypodermic use of tuberculin for diagnostic purposes is dangerous and unjustifiable. Wright's methods of diagnosis by the observation of the opsonic index are only casually mentioned, the technique being considered, as indeed it is, too complicated for the general practitioner. In the section dealing with treatment one gets full details of the composition and methods of administration of all the various forms of tuberculin; the doses recommended go far beyond those used in this country by those who follow Wright's teaching—even as much as 20 milligrammes of tuberculin R is given. Such a dose as this should, according to the findings of Wright, infallibly cause a permanent negative phase and most likely destroy the patient, yet the authors and many others continue to use these doses apparently to their satisfaction. This discrepancy between clinical experience and laboratory results seems to call urgently for further work for its elucidation. It would have been an improvement if the authors had given us some account of their results in more or less statistical form. For the rest there is a description of the numerous other preparations of the tubercle bacillus which have been introduced from time to time. For the most part these only serve as examples of fantastic pathology.

W. S. H.

Differential Diagnosis of Bacteria. By E. P. Minett, M.D., D.P.H., M.R.C.S. London: Baillière, Tindall and Cox, 1909. Pp. viii. and 182. Price 7s. 6d. nett.

This is apparently an attempt to compress the essential facts of bacteriology into sixty-eight very small pages, and, as one would expect, the information is always inadequate and in some cases positively

dangerous. One notes under plague that the reader is advised to inoculate an animal for diagnostic purposes; not a word about the precautions to be taken to avoid spreading the infection to the worker and his neighbours; there is no room for that in sixty-eight pages! The book even gives details for the preparation of a bacterial vaccine, and one notes that sterile water is recommended as a diluent. One is not very surprised to find further down that the injection of the fluid causes more pain than the prick of the needle; but one trembles to think of the results of injecting a vaccine prepared by a person who needed such a book as this for his guide. The book is too small and attempts too much; it is difficult to imagine a use for it except for pure "cramming" purposes, and "crammed" bacteriology is useless and dangerous. W. S. H.

Aids to Medicine. By Bernard Hudson, M.D.Camb., M.R.C.P. London: Baillière, Tindall and Cox. Pp. ix and 252. Price 3s. cloth nett, and paper 2s. 6d. nett.

When Euclid was asked by King Ptolemy, of Egypt, if it were necessary for him to go through his "elements" to become a mathematician, he replied "Yes, there is no royal road to learning." This remark of the great geometrician, though profoundly true, has not convinced posterity, or these "Aid Series" would not be published.

The author states that the object of this little work is to supply the student with a book for revision purposes of a convenient size to carry about. We think for revisal the student should make an epitome for himself from his text-book and notes of lectures. Whilst doing this, he would be fixing facts in his mind in a much surer fashion than by committing to memory such little books as these, which tend to give merely a superficial rather than a real knowledge of medicine.

It must be admitted, however, that the author has, on the whole, done his task creditably enough; he has used judgment in his condensations and has kept abreast of the times. We regret, however, to notice some omissions of importance, as, for instance, no allusion is made to the serum treatment of cerebro-spinal fever, which has done so much to decrease the mortality from this disease. Malta fever is dismissed without any remarks as to its causation, whilst it is stated that there is no distinctive rash in dengue.

To those to whom time is an object and who require to grasp facts without detail this little work will be of value. It is neatly got up and has an excellent index. A. A. S.

Current Literature.

The Hygiene of the Rank and File. (*Streffleurs Mil. Zeitsch.*, December, 1908.)—An article by Oberleutnant O. Pransa, on *Mannschafts Hygiene*, discusses the subject from the point of view of physical training, care of the skin, breathing exercises, bathing, cleanliness of underclothing, feet and air, route marching, &c. Several practical points are noted. In connection with physical training, it is pointed out that after exercises causing the men to perspire freely, the command to stand at ease is given, and the effect of this is to cause more or less sudden cooling of the body and risk of colds, &c. A horse is walked about or rubbed down if he finishes his work in a state of perspiration, and the same precautions should be taken with men. Ablution of the whole body daily with friction of the skin and change of underclothing is urged as of extreme hygienic importance. Objection is taken to the prescribed breathing exercises of gymnastic teachers, but the author considers that soldiers should be trained to use their lungs at the same time that they are trained to use their muscles and joints; and that they should be made to breathe through their nostrils. With regard to cleanliness of the underclothing, the Austrian soldier, it appears, receives two shirts yearly, and wears one day and night for a week at a time. It then goes to the laundry. The author's remedy for this is to give the soldier three shirts and to make him rinse daily the shirt he has worn in clean water. He has thus one shirt in wear each day, one drying, and one in reserve. Foot cloths and socks are considered worse than useless; and there is greater freedom of movement without them. The foot also becomes harder and soldiers soon get accustomed to wearing boots without foot coverings. In winter, however, in order to keep the foot warm, straw, cork, or asbestos material may be placed inside the boot. For ordinary wear in barracks a light and inexpensive sandal is recommended, the foot being otherwise bare. The soldier is recommended, as a hygienic measure, to sleep without his shirt; he is not likely to catch cold by being without it. The bedding must be aired daily; this is usually neglected. Barrack-room windows should be kept open all night even in winter, as the men are well supplied with blankets, &c. In connection with route marching it is recommended that soldiers should be taught to rub themselves dry during halts, and that a towel should be carried by each man in his knapsack. W. G. M.

Dr. Lardy's Sleigh Stretcher for Use in Mountainous Country. ("*Bulletin International de la Croix Rouge*," July, 1908.)—This stretcher consists of a frame of steel tubes mounted on steel runners which can be folded underneath, but which, when in use, are kept securely extended by a central arch of steel. Strong canvas is laced on the frame, and flaps are left which are fastened across the wounded man's body, arms and legs with straps, and he is thus held fast. The head is protected by three strong iron plates, which for dangerous journeys can be augmented by others, projecting right over the head. Under the neck is a piece of

canvas, with holes for lacing it, to prevent the head shaking about should the patient faint during the journey.

The stretcher is light—the weight does not exceed 54 lbs.—and it can be carried easily on the back, while in difficult ascents or descents it can be pulled over rocks, &c., by means of a cord. It has been tried several times, both by the Red Cross Society of Geneva, and by the Swiss Military Medical Society in dangerous spots on the Salève mountain, with extremely satisfactory results. It was found that a wounded man could be taken over rough rocks, steep ascents, and over *débris* without suffering shock or injury. When used over very high, steep rocks, it would be a good thing to furnish the stretcher with arches of iron across the front, over the body, so that if by chance the stretcher should turn over when suspended at the end of a rope, the wounded man (being well strapped in) would suffer no injury. The drawings show the method of bringing wounded men down mountain sides and precipices on this form of stretcher. W. G. M.

Improvements in System of Rationing in the German Army.—The following notes are given in the *Internationale Revue:* (1) A wheeled kitchen (2-horsed vehicle) is to be supplied to each company of infantry, battery of artillery, &c., but this will not avoid the necessity of soldiers carrying mess tins; and soldiers must be trained to cook for themselves.

(2) The wheeled kitchen is replenished at the company supply cart, which should carry one day's ration, three tea rations per man, and one hay ration per riding horse, with butcher's utensils. Each company should have a man skilled as butcher.

(3) Rations for war consist of:—

750 grammes bread,
or 400 grammes egg biscuits,
,, 500 ,, campaign biscuits.
375 grammes fresh, salted or frozen meat,
or 200 grammes smoked beef, mutton or pork,
,, ,, ,, ,, sausage,
,, ,, ,, dried ,,
,, ,, ,, smoked bacon,
,, ,, ,, tinned meat.
125 grammes rice, husked barley, wheat or barley groats,
or 250 grammes fruit or flour,
,, 1,500 ,, potatoes,
,, 150 ,, preserved vegetables,
,, 60 ,, dried vegetables,
,, ½ vegetables (rice) + 750 grammes potatoes,
,, 100 grammes vegetables (preserved) and 500 grammes potatoes.
25 grammes coffee roasted,
or 3 grammes tea.
17 grammes sugar.
25 ,, salt.

(4) The company supply carts are filled from supply columns and central stores, or from local purchase.

(5) A fifth supply cart is kept in each battalion as a canteen for purchase of necessary articles.

(6) The company supply carts are second line transport.

The article gives an account of an experiment in cooking, during the midday halt, of an ox of 550 kilogrammes slaughtered on the spot, and

divided amongst two battalions of the 154th regiment and Grenadiers at Jauer and Seignitz during manœuvres of August 12th, 1908. Each company prepared its meal differently, according to the above ration scale and its varieties, using only the soldier's mess tin and making a fire of wood carried by soldiers in the haversack. W. G. M.

Report on the Trial Trip of an Ambulance Train. (*Mittlgn. aus d. Artillerie u. Geniewesens*, October, 1908.)—When the regulations for ambulance trains were published, the Austro-Hungarian War Office ordered that a trial trip on the new system should be made by one of these trains, in order to make a practical test of the general usefulness of the regulations. The following is an account of the experiment.

In order to make matters clear, it is necessary to note the following description of what is officially included under the designation *Eisenbahn-Sanitäts Züge*, or railway trains of the Army Medical Service :—

(*a*) *Hospital Trains* (*Spitalzüge*) consisting of twenty-five or twenty-six fully equipped cars, accommodating in eighteen cars 144 wounded lying down, each car having eight cots, four of which are upper or suspended berths. These trains are only to be used for the transport of sick to the distributing zone from the clearing and distributing stations,[1] and should be made up as follows: One brake van (used for luggage), one commandant's car, one stores car, four cars for wounded, one car for *personnel*, four cars for wounded, one kitchen car, one kitchen supply car, six cars for wounded, one car for *personnel*, four cars for wounded, one material and equipment car.

Intercommunication between all the cars on the train must be arranged.

(*b*) *Improvised Ambulance Trains* (*Krankenzüge*) consisting of, say, twenty-five carriages suitably fitted up for the purpose. The cars are provided with lying-down accommodation in cots (as in the hospital trains), and with sitting-up accommodation on straw, seats, or other forms of equipment. These trains should carry sixty-four lying down (in cars accommodating eight men each), and 300 sitting up (in cars holding twenty each). They are for use at the clearing station in the evacuation zone, and when the hospital trains are insufficient (as is often the case after a battle), these improvised ambulance trains can be used for conveying wounded who are in less urgent need of being sent to the distribution zone. The arrangement of an improvised ambulance train should be as follows: One brake van (used for luggage), seven cars for sick sitting up, four cars for sick lying down, one commandant's car, four cars for sick lying down, eight cars for sick sitting up.

Communication must be arranged from the commandant's car to the cars accommodating sick lying down, at least, and all through the train, if possible.

Both these classes of ambulance train were represented in the train

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[1] The Clearing Station in the Austrian organisation is at the most suitable place on the line of railway nearest to the fighting line. The distributing station is a suitable place in the home territory from which sick and wounded brought back from the clearing station are distributed amongst the hospitals in the home territory.

which made the trial trip, in such a manner that one car of each type was included. It was therefore made up in the following way :—

Improvised Ambulance Train Cars.—One brake van fitted with Linxweiler apparatus, one car for sick sitting up provided with straw, one car for sick lying down provided with permanent railway cots down one side and, down the other, with improvised accommodation on the Port system[1] made up of railway sleeping berths, one car for sick lying down with improvised accommodation on the modified Port system made up of regulation stretchers down one side, and, down the other, of improvised stretchers, half of them made of straw mattress cases, and the other half of tent flies.

Hospital Train Cars.—One commandant's car, one stores car, one car for sick, one car for *personnel*, one kitchen car, one kitchen supply car, one material and equipment car.

To make up the train to its normal length of twenty-five cars, ordinary passenger cars and goods trucks were used, and so arranged that the hospital train tested was placed at the end of the train, where the vibration and oscillations in going round curves, &c., are felt most.

The equipment and arrangement of the train was carried out in the Vienna workshops of the Western Railway during the latter part of April, 1908. It did not appear necessary to fix a special day for the commencement of the work of adaptation, as it could not be carried out all at once, but only by degrees, as the various articles requisitioned came in from the different stores, &c., namely, Garrison Hospital No. 2, Clothing Depôt No. 4, the Central Depôt of Medical Stores, Ordnance stores, workshops, &c. Garrison Hospital No. 2 supplied a medical officer as commandant, and, together with Garrison Hospital No. 1, fourteen men of the medical corps as *personnel*, as well as two cooks who carried out the cooking experiments mentioned below. Once all these men and materials were gathered together at the railway workshops, the complicated and difficult work of preparation went forward with great rapidity. All those concerned had the satisfaction of realising that in time of war hospital trains could be prepared and equipped within a week, provided care was taken to have material and *personnel* ready.

It is worth while mentioning the following details of the work of equipment. It was discovered that the best and most comfortable accommodation for men sitting up, when straw is used (which could also be employed, if necessary, for lying-down accommodation), is an allowance of 22 lbs. of straw per man, so arranged on the floor that there is about 1 square yard of bare space round each door. Thus a car for twenty sitting up requires a little less than 4 cwts. of straw, so that for an ordinary improvised train from three to four wagon-loads of straw are necessary.

Much time can be saved by preparing goods wagons for patients lying down on the modified Port improvised system. In times of emergency it may be reckoned that if the requisite materials, such as boards and supports of the correct lengths, be kept ready, four men (even if they are not highly skilled) can prepare a car and have it ready for use in fifteen minutes. The skilled workmen of the railway shops were able to complete the work in a far shorter time.

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[1] Cots slung by rings on hooks fixed into the side of the car.

The train started on its journey during the afternoon of April 27th, and returned to Vienna early on the 29th of that month. It then remained at the shops for several days for inspection and for the preparation of inventories. The route chosen by the Minister for Railways was that of Vienna, Amstetten, Salzthal, Amstetten, Vienna, on account of the steep gradients and sharp turns which would be encountered. That this journey of about 300 miles took nearly thirty-seven hours is due to the fact that the speed averaged little more than 8 miles per hour, as it was not thought desirable to travel at a faster pace than would be possible in war time, and also because it was found necessary to shunt the train on to sidings at various points in order to allow ordinary traffic to proceed.

The train carried a large number of experts and others. Various departments of the War Office, the Railway Department, the General Staff, and the Technical Military Committee were represented, as well as railway officials. A large number of officers, among whom were many medical officers, also showed great interest in the experiment. The only thing that was wanting was the presence of those on whose behalf the experiment was undertaken—namely, sick and wounded.

It was nevertheless found possible to form an accurate opinion of the value of this means of transport, especially in connection with the various forms of lying-down accommodation, which is a most important feature in the transport of sick. The methods tried were found to be remarkably suitable and satisfactory. Of course, no other result was anticipated with regard to the specially constructed railway cots, although it was ascertained that the upper or suspended berths, which had been considered the best, are, as a matter of fact, not so comfortable both on account of the movement of the train being felt more in them than in the lower berths, and on account of their narrowness, which makes it possible for the patient to be thrown out when asleep. It seems desirable, therefore, that a safety strap be provided in order to render the patient safe. These upper berths are, however, much more convenient for nursing and looking after the sick.

The improvised lying-down accommodation, whether formed of stretchers or tent flies, or of the Port suspension system, proved most successful, and was, for people in good health at least, nearly as comfortable as the accommodation on specially fitted hospital trains. Stretchers and tent flies had even this advantage, that they took the form of and gave to the movements of the body better than a rigid cot, so that there was not the same risk of patients being thrown out. Of the various forms of improvised accommodation, the tent flies were specially satisfactory and are much to be recommended, as the medical *personnel* can always improvise accommodation of this kind from the *tentes d'abri*. The train *personnel* also slept for a whole night on the straw provided for sitting-down patients and found it most comfortable. Further, the Linxweiler apparatus proved to be invaluable, and cannot be too highly recommended for railway transport.

Advantage was taken of a two hours' stop at Amstetten to load the ambulance cars of the hospital train with dummy patients. This undertaking brought up the question whether the fact of the heating stove and the commode being placed near the sliding doors of the ambulance car did not hinder the process of loading. It was, however,

proved that this could be avoided by moving the stove a little to one side. It was found impracticable to have the commode as a fixture, and it was decided in future to make it movable. The loading of the cars was carried out, in accordance with the regulations, in about ten minutes, although as this experiment was only partial and not tried with a whole train of eighteen ambulance cars and 144 lying-down patients its value was proportionately lessened.

Lastly, an important experiment was tried with the cooking arrangements. It was considered desirable to test whether it would be possible to use the cooking apparatus belonging to the smaller ambulance trains of the past for the requirements of the present organisation. For this purpose orders were given that a hospital midday meal for 200 persons, both invalids and nursing staff, should be prepared at one time, all patients to be supplied with substantial diets (Nos. 2 to 4), in order to make the experiment the more complete. Although no special dishes nor difficult cooking were asked for, this meant the preparation of 200 portions of vermicelli soup, 130 portions of roast beef, 70 portions of roast mutton, and 200 portions of stewed beans. It was found that such a meal could be prepared in about five hours, and that, therefore, if reasonable notice of requirements was given, the cooking arrangements of hospital trains need not be altered.

In concluding the practical portion of the report, the authors again emphasise the keen public interest in the experiment, and remark how great was the patriotic sympathy of the nation in all military questions and especially military medical matters. The daily press, as well as the medical and engineering journals, gave full reports of the experiment, and the number of military, railway, and medical associations and persons who visited the train surpassed all expectation. The general impression was a very favourable one, the only criticism being that in hospital trains the provision for administration services appeared to be comparatively large, as, out of eighteen cars for the use of sick, no less than seven were allotted for administrative purposes. This point was considered, and resulted in a definite recommendation which is noted below.

Of all the valuable lessons to be learnt from the experiment, the most important point to be noted is the fact that ambulance trains, made up and equipped on the lines laid down in the new regulations, will be of the greatest service in the field.

The sharply defined difference between the ambulance trains according to the rate at which they travel and the transport material of which they are made up, should do much to solve the difficult problem of evacuation during important modern engagements. The urgent need, after heavy fighting, of trains capable of travelling over a wide area between the evacuation (clearing) stations and the distributing zone can only be met by keeping prepared and ready for use on the order of the Commander-in-Chief a large number of such trains.

The make-up of the trains should be in the order noted above, as this was found to be the most useful. The arrangement that hospital trains should have the commandant's carriage at one end and the car containing requisites at the other (although it does not matter which is in the front and which at the back), is made because the two medical officers accompanying the train will have their quarters one at each end of it. Formerly these two officers shared a car in the middle of the train, but this was

found to be inconvenient, as the one on duty could not be called without disturbing the other who was off duty. Also, officers who remain on duty with the train during a whole war will, in this way, be able to make themselves more at home and sometimes obtain a little privacy.

The experiment of always travelling at the same rate of speed, as is prescribed for time of war, showed how trying to the patients must be the motion of the train when the journey is lengthened by constant stops, and this frequent stopping might even lead to serious breakdown with the present small number of ambulance trains. Every endeavour should therefore be made to hasten the journey as much as possible by having all the requisite material and food supplies on board, and although the speed cannot be augmented, the journey can be shortened by only stopping at such stations as are necessary for medical and railway purposes. All the patients should be collected at one place for entraining, (the evacuation station), and they should also be detrained at one place only. This arrangement would mean that hospital trains should be kept quite apart from all other trains used for military purposes, and should be run according to a special time-table and a special system.

With regard to details of equipment of the trains, the following were noted :—

(*a*) *For all Trains.*—The present communication passages between cars are not sufficiently safe. Persons passing over them when the train is going round a curve by night, when travelling at a high rate of speed, or even when the passenger has not a hand free for holding on to the chain, might easily be thrown out. The internal lighting by means of lanterns containing candles is insufficient, unwholesome, and uneconomical. A steam disinfector should be provided for each train.

(*b*) *For Improvised Ambulance Trains.*—The regulations prescribe that eight goods wagons shall be provided for each permanent improvised ambulance train, for conversion into ambulance cars. It will often happen that more are available for the purpose, and in that case they should certainly be used. As the Austrian goods vans have an end to end communication with one another, the medical officers can pass from one car to the other, no matter how many are used, in order to attend to patients during the journey. For this purpose, extra communication bridges and hand chains should be stored at the equipment workshops.

The want of means of warming in the improvised train cars will be much felt during a winter campaign. As stoves have, for various reasons, been forbidden in ambulance trains, some of the experts favoured the installation of heating by petroleum, while others were in favour of briquette boxes.

(*c*) *For Hospital Trains.*—It was suggested, in order to lessen the large percentage of administrative cars on these trains, that, in view of the supply stations that would probably be formed on the line of rail, the kitchen supply car and even the kitchen car itself might be omitted in favour of one or two additional ambulance cars. Against this may be urged the possibility of the supply stations having to be moved owing to the exigencies of war and the fear of despatching an ambulance train insufficiently provisioned ; also the fact that even with such an arrangement only 152, or at the utmost 160 sick, could be accommodated instead of the regulation 144. More important was a suggestion, with the same end in view, to increase the length of ambulance trains from twenty-five

to thirty-five cars. Such a train could accommodate 200 lying-down patients in at least twenty-five ambulance cars; this would increase the rapidity with which sick and wounded could be brought to the distributing zone, but it involves the construction of more cars, the provision of more fittings, and an increase in *personnel*. Financial reasons, therefore, interfere at present with the adoption of this suggestion, but possibly at some future time the regulations will be amended in this sense.

The whole question of ambulance train equipment is influenced by the satisfactory results of the trials with the Linxweiler apparatus. This showed that the purchase of a large supply of these fittings should be taken into consideration in spite of the cost (about £15 each). It was estimated that the requirements of a whole army would be 5,000 of these apparatus, with 20,000 stretchers. This represents a sum of £125,000 in round figures, but by a suitable distribution of the equipment, the preparation of regular hospital trains can be dispensed with because each train returning empty from the front can be converted, as required, into an ambulance train within a few hours, by using this apparatus and stretchers. The money that would be spent, therefore, in providing this equipment will be saved by lessening the expenditure on regular hospital trains and on additional hospitals when the zone of evacuation is not defined.

All those who were interested in the experiment and realised its importance expressed the opinion that it was in the interests both of military preparedness and of humanity that further trials with completely equipped ambulance trains carrying patients should every now and then be made. For instance, the yearly manœuvres would provide an excellent opportunity for doing so. Hospital and improvised ambulance trains could by turns carry all sick and footsore men during the manœuvres back to the military hospitals. This would be a really good test of the transport capabilities, as such a state of affairs is the nearest approach to war that can be obtained in times of peace.

The arrangements necessary for carrying out such trials, with the exception of preparing the trains, would be to collect all the sick in large buildings within the manœuvre area until the trains are ready for their reception. In this manner many difficult problems connected with medical transport might be solved, and also it would give the patients a chance of receiving proper treatment without delay. Medical officers also would have a good opportunity of being trained for war and of organising and carrying out many details concerned with the medical service, such as the formation of large evacuating stations, classifying of wounded, medical reconnaissances for the selection of entraining stations, the despatch of wounded with attendant details, such as arranging transport to the railway station, &c., the preparation of hospitals, and many other problems for perfection in which much practice in time of peace is necessary. The cost of such an experiment would be moderate, that is to say, not more than a few hundred pounds. W. G. M.

Beobachtungen über Culiciden (Observations on Culicidæ). By B. Galli Valerio and J. Rochaz de Jongh (*Centralbl. f. Bakt.*, Bd. xlix., Heft 4).—These observers give the result of their investigations on the *Culicidæ*, carried out in the pools of the Orbe ebene, near Lausanne, in

Switzerland. They describe their observations under five different heads, as follows:—

(1) *Observations on the Hibernation of the Culicidæ.*—The authors found that many of the eggs of the *Culicidæ* wintered under the withered leaves near puddles, or in dried-up puddles, and the eggs found there showed, in the laboratory, a quicker transformation into larvæ and nymphæ than those eggs which wintered in the puddles themselves. The first nymphæ of *Anopheles bifurcatus* were found in the Orbe ebene on April 19th (air temperature 7° C., water temperature 6° C.), and at Sondrio on March 26th (air temperature 7° C., water temperature 10° C.). The *A. maculipennis* was first observed in the Orbe ebene on April 19th.

(2) *Observations on the Breeding-places of Culicidæ.* — After emphasising the importance of small stagnating collections of water as breeding-places, and the comparative safety of larger pools with superficial currents and exposed to the action of the wind, the observers go on to state that they consider the large increase in mosquitoes in this district in 1908 to be due to the spread of market gardens. These necessitate the use of barrels and other water-holding receptacles for the watering of the vegetables, and these are very suitable breeding-grounds for the mosquito. They also demonstrated the larvæ of both *A. bifurcatus* and *A. maculipennis* in polluted water, even when mostly manure and smelling strongly of sulphuretted hydrogen, and emphasised the fact that such pools are quite suitable breeding-grounds for these mosquitoes.

(3) *Observations on Mosquito-bites.* — Experiments were carried out to determine the protection from mosquito-bites produced by smearing the skin with æthrol and deci-äthrole, prepared by Dr. Noerdlinger, in Flössheim. They tried different preparations and combinations of these substances, but all gave similar results. The duration of the protection varied from five to thirty minutes, with an average duration of twenty minutes.

(4) *Observations on the Laying of Eggs by the Culicidæ.* — The observers draw attention to the difference in the microscopical appearances of the eggs of *Culex cantans* from those of the other *Culicidæ*, which lay eggs in rafts. They also note that *C. nemorosus* lays its eggs in rafts exactly like *C. pipiens* and *C. annulatus*, but the eggs are smaller and of a dark velvet colour.

(5) *Observations on the Destruction of the Larvæ and Nymphæ of Culicidæ.*—A striking example of the important *rôle* of *Lemna palustris* (Duckweed) in the abolition of the mosquito was shown in a pool which was covered at one end with this plant. That end remained quite free from larvæ and nymphæ, whereas the other end of the same pool, where there was no *L. palustris*, contained numerous larvæ and nymphæ. Eysell's observation, that the Utriculariæ (Bladder-wort) seize the larvæ and take them into their vesicles, was confirmed in the case of the *Utricularia vulgaris*. New experiments were also carried out with water animals; *Rana esculanta, R. temporaria, Bufo vulgaris*, and *Bombinator igneus* touched neither the larvæ nor the nymphæ of Culex, while *Discoglossus pictus, Triton cristatus*, and *T. alpestris* devoured them in large numbers. Other very important destroyers of these larvæ are *Phoxinus lævis* and *Telestes muticellus*, and the authors question the advisability of the expense incurred in acclimatising tropical fishes when

fishes are naturally present which multiply rapidly and which devour the Culex larvæ.

No definitely beneficial results were obtained by stirring up the pool and setting free the sulphuretted hydrogen, as recommended by Vogel. Experiments were carried out with the saprol powder of Dr. Noerdlinger. They used solutions of 2 per cent., 1 per cent., 0·5 per cent., 0·3 per cent., 0·15 per cent., 0·075 per cent., and 0·05 per cent. The three first solutions caused the larvæ to sink in thirty to thirty-five minutes. These solutions kept well, and were still efficacious after seven days, exposure to the air. W. E. M.

Das Treponema pallidum in der Syphilitischen Placenta (Treponema Pallidum in the Syphilitic Placenta). By Rodolfo Stanziale (*Centralbl. f. Bakt.*, Bd. xlix., Heft 4).—Though the presence of *T. pallidum* in the syphilitic placenta has been well established by numerous observers, the author noticed that in a series of cases showing the pathological changes in the syphilitic placenta and published by him in 1906, in the single case which he examined for the presence of *T. pallidum*, that organism was not present. As the patient had undergone active anti-syphilitic treatment during the pregnancy, Professor Stanziale thought that might account for the absence of the *T. pallidum* from the placenta even though the child, in the case above mentioned, developed signs of syphilis four months after birth. The author brings forward a series of eight new cases in support of this.

In Cases 1, 2, and 3 the mothers contracted syphilis a short time before pregnancy, in Cases 4 and 5 the husbands had syphilis before marriage, in Cases 6 and 7 the syphilis was contracted during pregnancy, and the 8th case was a woman with tertiary syphilis with gummatous ulceration of the soft palate, and gummatous periostitis of sternum and tibia. All were subjected to active anti-syphilitic treatment during pregnancy with the following results. Case 4 aborted at the seventh month, and in Case 3 a dead child was born. In all the others the children lived, but all, with the exception of the last case, developed symptoms of congenital syphilis. With the exception of the last case all the placentæ showed the usual characteristic syphilitic changes. Some pieces of the placenta and umbilical cord were examined in each case by Levaditi's method, but in only one case (No. 3, where the fœtus was born dead) was the *T. pallidum* present. Even in that case it was only present in small numbers, and limited to the walls of the blood-vessels and to the villi of the fœtal part of the placenta.

The absence of the *T. pallidum* from the placenta is no proof, as the above cases show, that the child will not develop evidences of syphilis. W. E. M.

Neuere Untersuchungen über die Vergleichende Cytologie der Spirillen und Spirochäten (New Research into the Comparative Cytology of Spirilla and Spirochætæ). By N. H. Swellengrebel (*Centralbl. f. Bakt.*, Bd. xlix., Heft 4).—After combating, in a most thorough manner, the various objections to his previous work, the author gives the results of his new observations on *Spirillum giganteum, Bacillus maximus buccalis*, and *Spirochæta bilbianii*.

In *S. giganteum* and *B. maximus buccalis*, in addition to the fine

honeycombed protoplasm, there is present a definite chromatin substance, either in the form of granules or in threads arranged in diagonal bands, or in zigzag lines. These are of a true chromatin nature, and are not the result of degeneration, as some authors assert. The chromatin network obtained by plasmolysis is derived from the real chromatin, but does not germinate, and takes no part in the life of the organism.

In *S. bilbianii* the protoplasm is coarsely honeycombed; the chromatin is present in the form of granules or diagonal bands, as in the two former organisms. Plasmolysis occurs in the spirochæta exactly as in bacteria. The pseudocysts of this organism have the same construction as the plasmaglobules of *S. giganteum*.

The author closes the article with a consideration of the relationship of spirochætæ and bacteria. W. E. M.

Correspondence.

A SUGGESTION FOR THE CONVEYANCE OF PATIENTS FROM WARD TO OPERATING THEATRE AND BACK.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

Sir,—I have often noted the want of method in the operating theatre complained of by Lieutenant-Colonel Kirkpatrick, C.M.G., in the Journal for March, and his method therein illustrated is a great improvement on the ordinary procedure. I maintain, however, that the patient should not be hand-lifted at all, and the procedure adopted in my hospital here is as follows: I use a stout piece of canvas, 6 feet long by 2 feet 6 inches broad, having the sides turned down all along so as to form a loop through which a round pole can be inserted on either side; two iron bars with loops at each end to slip over the poles complete the arrangement. The canvas bottom is placed in the bed or on the operating table if the patient can walk to the theatre, and any sheets, waterproof sheets, &c., required are made up on the top of this canvas bottom.

When required, the poles are inserted, the irons slipped over the pole ends at head and foot, the stretcher is then lifted complete with patient on it. When the patient has been placed in bed after the operation, the bars are slipped off and the poles removed; the canvas can be removed afterwards when the patient has recovered from shock and nausea no longer exists.

A canvas bottom can be thoroughly boiled before use and does not in any way interfere with a patient's comfort; two bearers can do all the work, although, of course, there should be one on each side when the patient is being carried.

I am, Sir, &c.,

W. Watson Pike,

Lieutenant-Colonel, R.A.M.C.

A METHOD OF MOVING HELPLESS PATIENTS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—May I suggest a very simple method of moving helpless patients?

A canvas stretcher (from which the poles are removable) is placed on the floor at the foot of the patient's bed and in a line with its long axis.

The patient is lifted on his under-sheet by four bearers, two on each side. Advancing by side steps, they lift him over the foot of the bed and place him on the stretcher.

Having arrived at the operating theatre, the stretcher is placed on the ground in a line with the long axis of the table. It is then grasped by four bearers (two on each side), lifted over the head of the table into position and the poles withdrawn.

At the end of the operation, the poles are re-introduced and the patient transferred on the stretcher to the ward. He is lifted on to the bed on the stretcher, by carrying him over the foot as before. The canvas is then removed by rolling the patient to one side, or it may be left in position for some time after removing the poles and traverses.

Failing a canvas theatre stretcher, the work can be done equally well by lifting the patient, by means of a sheet, on to or off the service stretcher or table.

The essence of the whole manœuvre consists in always lifting him *over the foot* of the bed or table by two bearers placed on each side.

I am, Sir, &c.,

Sierra Leone,
April 14th, 1909.

F. J. W. PORTER,
Major, R.A.M.C.

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